VOL. XXXV. PART 9 SEPTEMBER, 1956

THE REVIEW OF APPLIED MYCOLOGY

Compiled from
WORLD LITERATURE ON PLANT PATHOLOGY
AND APPLIED MYCOLOGY

RECENT PUBLICATIONS

COMMONWEALTH PHYTOPATHOLOGICAL NEWS
Issued quarterly, 5s. per annum

FUNGI AND PLANT DISEASES IN THE SUDAN
By S. A. J. Tarr. 128 pp., 75 figs., 1955. *Price* £1. 5*s.* post free

THE GENUS PHYTOPHTHORA
Diagnoses and figures from the original papers
By Grace M. Waterhouse. 120 pp., 66 pl., 11 figs., 1956. *Price* 15*s.* post free

TOBACCO DISEASES
With special reference to Africa
By J. C. F. Hopkins. 204 pp., 54 ½-tone plates, 5 col. plates. *Price* £1. 15*s.* post free

For recent Mycological Papers and other publications
see pp. ii and iii of the cover

THE COMMONWEALTH MYCOLOGICAL INSTITUTE
KEW, SURREY

Price 6s. net

COMMONWEALTH MYCOLOGICAL INSTITUTE

EXECUTIVE COUNCIL: J. E. C. COVENTRY, B.A., M.Sc. (*Chairman*), Federation of Rhodesia and Nyasaland; C. E. LAMBERT, C.M.G. (*Vice-Chairman*), Colonial Territories; W. C. TAME, United Kingdom; J. G. MALLOCH, M.B.E., Canada; A. SHAVITSKY, Australia; V. ARMSTRONG, B.Sc., Ph.D., D.I.C., New Zealand; E. D. ANDREWS, Union of South Africa; T. SWAMINATHAN, I.C.S., India; (*Vacant*), Pakistan; V. A. NICHOLAS, M.B.E., Ceylon.

Secretary: Sir HERBERT HOWARD.

STAFF: *Director and Editor*: S. P. WILTSHIRE, M.A., D.Sc. *Assistant Director*: H. A. DADE, A.R.C.S. *Mycologist*: E. W. MASON, O.B.E., M.A., M.Sc. *Assistant Editors*: J. C. F. HOPKINS, D.Sc., A.I.C.T.A.; GRACE M. WATERHOUSE, M.Sc. *Assistant Mycologists*: M. B. ELLIS, Ph.D.; F. C. DEIGHTON, O.B.E., M.A.; C. BOOTH, M.Sc.; AGNES H. S. BROWN, Ph.D. *Sub-Editor*: D. JEAN STAMPS, Ph.D. *Colonial Pool of Plant Pathologists*: R. A. ALTSON, B.Sc., A.R.C.S.; P. HOLLIDAY, M.A.; B. E. J. WHEELER, Ph.D.

SULPHATE OF COPPER

98/100% PURITY

CRYSTALS AND POWDER

FUNGUS DISEASES

Control and prevent by spraying with Bordeaux Mixture made with the best quality Sulphate of Copper.

COPPER DEFICIENCY

Sulphate of Copper in powder form is also widely used for the correction of Copper Deficiency of the soil and in animal nutrition.

BRITISH SULPHATE OF COPPER ASSOCIATION LTD.

1 GREAT CUMBERLAND PLACE, LONDON, W.1

Telegrams: BRITSULCOP, WESPHONE, LONDON

Telephone: PADDINGTON 5068/9

A DICTIONARY OF THE FUNGI

By G. C. AINSWORTH and G. R. BISBY

Fourth edition now available: viii+475 pp., 10 plates, 20*s*., post free.

AN INTRODUCTION TO THE TAXONOMY AND NOMENCLATURE OF FUNGI

By G. R. BISBY

Second edition now available: vii+143 pp., cloth, 10*s*., post free.

MISCELLANEOUS PUBLICATIONS OF THE COMMONWEALTH MYCOLOGICAL INSTITUTE

No. 6. Generic names of fungi proposed for rejection. *By G. R. Bisby*, 59 pp., 1949. *Price* 3*s*. 6*d*.
No. 7. Bibliography of systematic mycology, 1948. 34 pp., 1949. *Price* 2*s*.
No. 8. Bibliography of systematic mycology, 1949. 28 pp., 1950. *Price* 2*s*.
No. 9. Bibliography of systematic mycology, 1950–1951. 42 pp., 1952. *Price* 3*s*.
No. 10. Bibliography of systematic mycology, 1952. 25 pp., 1953. *Price* 3*s*.
No. 11. Bibliography of systematic mycology, 1953–1954. 46 pp., 1955. *Price* 5*s*.
No. 12. The genus Phytophthora. Diagnoses (or descriptions) and figures from the original papers. *By Grace M. Waterhouse*, 120 pp., 66 pl., 11 figs., 1956. *Price* 15*s*.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD, BY CHARLES BATEY PRINTER TO THE UNIVERSITY

COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXXV SEPTEMBER 1956

C. A. 4 OCT 1956 FILE

LEBEN (C.) & KEITT (G. W.). **Phytotoxicity of antimycin A.**—*Antibiot. & Chemother.*, 6, 3, pp. 191–193, 1 fig., 1956.

At the Wisconsin Agricultural Experiment Station a suspension of 200 μgm. crystalline antimycin A-35 per ml. of the oil S/V sovaspray 100 (Socony-Vacuum Oil Co.) was sprayed in a greenhouse on Bonny Best tomato plants, some of which had been inoculated with the early blight fungus [*Alternaria solani*: *R.A.M.*, 34, p. 238], while others had merely been kept in a moist chamber. The young leaves and upper parts of the stem in both groups turned black and shrivelled within 24 hours of spraying with the antibiotic. At a 25 μgm. concentration it usually caused total necrosis of the young leaf and stem area in one day, while the portions of the stem adjoining the dead area were somewhat enlarged and marked with small fissures. In three tests on young unfolding leaves the minimum lethal concentration in two was 0·6 μgm. per plant and in the other 0·3 μgm. In two experiments the antibiotic was harmless to tomato plants in a water suspension of 25 μgm. per ml., as also was 5 μgm. per ml. antimycic acid, a degradation product (*J. Amer. chem. Soc.*, 75, p. 1100, 1953).

In further trials on other species of plants with concentrations up to 25 μgm. per ml. of the oil suspension of antimycin A radish seedlings were undamaged either by the oil or by the antibiotic. The former alone was phytotoxic to barley, cucumber, and bean (*Phaseolus vulgaris*) and no further injury appeared to result from the inclusion of antimycin A.

GERDEMANN (J. W.). **Relation of a large soil-borne spore to phycomycetous mycorrhizal infections.**—*Mycologia*, 47, 5, pp. 619–632, 16 figs., 1955.

Inoculation studies at the Department of Agronomy, University of Illinois, Urbana, with a large, yellow, unicellular spore, 291 to 812 μ in diameter, commonly present in Illinois soils, showed that it caused a mycorrhizal infection of the phycomycete type in plants of several genera. The seedlings were grown in aluminium foil funnels containing sand infested with the spores. The hyphae passed through the outer cortex of plant roots intracellularly and became intercellular as they grew through the root. Arbuscules developed in cortical cells outside the endodermis. Hyphae within the roots were non-septate. After penetration tight bunches of echinulate spores formed on the external mycelium. The internal and external vesicles frequently present in field conditions did not form in artificial inoculations. Cross-inoculations with spores from known sources indicated a wide host range, the same strain, apparently, infecting the roots of red clover, maize, strawberry, and sweet clover (*Melilotus alba*).

KIMURA (K.). **Diploidisation in the Hymenomycetes I. Preliminary experiments.**—*Biol. J. Okayama Univ.*, 1, 4, pp. 226–233, 3 figs., 1954.

At the Department of Biology, Okayama University, Japan, diploidization

in *Coprinus macrorhizus* f. *microsporus*, *Lentinus tigrinus* [*R.A.M.*, 33, p. 648], *Trametes vittata* [loc. cit.], and *Pleurotus ostreatus* was carried out by placing a fragment of diploid mycelium on the edge of a large haploid culture. Illegitimate combinations took longer than legitimate ones in a given species. Diploidizing nuclei travelled more rapidly through older hyphae than through younger ones, the maximum speed of the process being 3·2 mm. per hour for *C. m.* f. *microsporus*, 1·1 mm. for *P. ostreatus*, 0·7 mm. for *L. tigrinus*, and 0·6 mm. for *T. vittata*. There was some correlation between speed of diploidization and the ratio between the growth rates of diploid and haploid mycelia in any one species [see next abstract].

KIMURA (K.). **On the growth rate of mycelia in the Hymenomycetes.**—*Biol. J. Okayama Univ.*, 2, 1, pp. 7–12, 1954.

At the Department of Biology, Okayama University, Japan, comparative studies were conducted on the growth rates of haploid and diploid mycelia of some hymenomycetes [see preceding abstract]. Young diploid mycelia of *Polystictus abietinus*, *Coprinus macrorhizus* f. *microsporus*, and *Pleurotus ostreatus* grew more rapidly than the haploid; with *Lentinus tigrinus* and *Trametes vittata* there was little difference.

BROWN (W.). **On the physiology of parasitism in plants.**—*Ann. appl. Biol.*, 43, 3, pp. 325–341, 1 pl., 1955.

In this presidential address, delivered to the Association of Applied Biologists on 1st April, 1955, the author discussed the physiology of parasitism in plants with special reference to the post-penetration stage [cf. *R.A.M.*, 14, p. 189; 15, p. 597]. Three lines of investigation were reviewed: the condition of the host tissue [cf. 31, p. 321], the factors affecting enzyme production [cf. 31, p. 623; 34, p. 666], and the differences between the pectolytic enzyme systems [cf. 33, pp. 56, 122; 34, pp. 298, 553; 35, p. 385]. It can be concluded that the capacity of an organism to secrete pectolytic enzymes is a necessary but not a sufficient condition for its ability to behave as a parasite, and that the parasitic process must depend on the intricate interplay of a number of factors. Although the address dealt with facultative parasites, the author indicated the probability that many of the results described might apply to obligate parasites, and that the agent inhibiting the growth of *Puccinia graminis* on an unsuitable host may, possibly, be comparable to that which acts similarly on *Phytophthora infestans* in the cells of a resistant potato variety.

GRAY (W. D.) & BUSHNELL (W. R.). **Biosynthetic potentialities of higher fungi.**—*Mycologia*, 47, 5, pp. 646–663, 1 fig., 1 diag., 1955.

Experiments conducted at the Department of Botany and Plant Pathology, Ohio State University, Columbus, with 50 different strains and species of higher fungi showed that an index to the biosynthetic potentialities of a fungus may be obtained by calculating the percentage of utilized substrate carbon converted to mycelium carbon and carbon dioxide carbon. Greater accuracy results if the average quantity of carbon converted daily is taken into account. Economic coefficient values usually vary inversely with percentages of substrate carbon thus converted, but the correlation is not close, and the economic coefficient alone is not an adequate basis for the evaluation of the biosynthetic potentialities of a fungus.

The ascomycetes and basidiomycetes studied varied greatly in their biosynthetic potentialities. In 39 of the 53 experiments, under 50 per cent. of the utilized substrate carbon was assimilated and converted to carbon dioxide. The ratios of carbon dioxide carbon to mycelium carbon varied from 0·37 to 5·36; in over 90 per cent. of the fungi this ratio was under 2 and in over 50 per cent. it was under 1 per cent. Acid metabolic products were formed in very small quantities by all the

organisms, and it would seem that their metabolism differs fundamentally from that of many of the mould fungi.

DORN (MARTHA). **Untersuchungen über das Auftreten von Sektoren in Pilzkolonien (insbesondere bei Alternaria tenuis).** [Studies on the occurrence of sectors in fungus colonies (especially in *Alternaria tenuis*).]—*Arch. Mikrobiol.*, 21, 3, pp. 310–328, 3 figs., 1955.

In experiments at the Phytopathological Institute, Bonn, Germany, a strain of *Alternaria tenuis* from sugar beet, which had shown a strong tendency to the formation of dark mycelial sectors in previous studies [*R.A.M.*, 31, p. 586], was grown on two media, (A) that of Neergaard [loc. cit.] and (B) one prepared by the author consisting of 1 per cent. each of lactose and peptone, 0·5 per cent. magnesium sulphate, 0·2 per cent. potassium dihydrogen phosphate, and 2 per cent. agar, the former favouring and the latter discouraging sectoring.

On A the conidia from both normal and sectoring cultures formed sharply contrasting, reddish-purple sectors at a minimum distance of 1 cm. from the site of inoculation, the line of demarcation being accentuated by a high concentration of agar (upwards of 4 per cent.) and the use of sucrose as a carbon source. Transferred to B, the mutant mycelium continued to form sectors of a cherry-red colour. Its hyphae were filled with purple conglomerates, soluble in hot potash lye, which inhibited the development of normal mycelium. No sectors developed on B freshly inoculated with conidia.

A. tenuis formed numerous anastomoses but few sectors on silica gel, diatomaceous earth, and sand. Sector formation was most abundant at the optimum temperature for the development of the fungus (25° to 26° C.), in darkness, at pH 5 to 7, with agar and gelatin concentrations of 4 to 8 and 20 to 40 per cent., with potassium nitrate as a source of nitrogen, and glucose, fructose, sucrose, and maltose as carbohydrates. Sectoring was inhibited, on the other hand, by temperatures below 18°, pH 3 to 4, and the use of arabinose, mannite, xylose, galactose, lactose, starch, and cellulose as carbon sources.

The paper concludes with a list of fungi in which sectoring has been reported, followed by a six-page bibliography.

STEVENSON (F. J.). **Breeding varieties of Potato resistant to diseases and insect injuries.**—*Amer. Potato J.*, 33, 2, pp. 37–46, 1956.

The author gives a brief account of the methods of potato breeding, and its development in the United States, leading to the establishment, in 1929, of the National Potato-breeding Programme, which is carried out by the State agricultural experiment stations in collaboration with the United States Department of Agriculture. In 1954 62 per cent. of all certified 'seed' grown in the U.S.A. originated from the 35 varieties bred since the inception of the scheme.

The various diseases and pests against which resistance has been sought are referred to, with the varieties resistant to each, and 14 varieties are tabulated in accordance with their multiple resistance.

SILBERSCHMIDT (K. M.). **Informe sobre las observaciones hechas en los campos de la Papa en la Sierra del Perú.** [Report on observations in Potato fields in the highlands of Peru.]—*Inf. Estac. agríc. La Molina* 93, 18 pp., 6 figs., 1954. [English summary. Received 1955.]

An investigation of the virus diseases present in seed potato plantings in the highlands of central and southern Peru [*R.A.M.*, 25, p. 42] during 1954 revealed 78 to 84 per cent. virus infection, mostly of the mosaic type, in plants of the Maco variety on the Maco estate in the central region, 11,800 to 13,120 ft. above sea level. Of the 92 per cent. infection in the Casa Blanca variety, a calico type virus [? a strain of lucerne mosaic virus] predominated. Casa Blanca 'seed' from the

Mantaro and Tarma valleys showed a higher incidence and severity of purple-top [? aster yellows virus] and calico than that from higher altitudes at Maco or Casa Blanca. There was 100 per cent. virus infection, mostly calico virus and a complex infection known as 'streak' [? potato virus Y], in the Casa Blanca variety on the Casa Blanca estate (13,500 ft.). Nearly all the plants of this variety on the Tambo estate (11,100 ft.) were affected by calico and leaf curl [? potato leaf roll virus], and in some cases by very severe streak. Several cases of calico and streak were also observed in Casa Blanca plants in the Tarma valley (10,000 ft.) in spite of their advanced state of maturity.

In all the fields of table potatoes at Arequipa (8,200 ft.) in the southern highlands there was a high incidence of degeneration and marked symptoms of stunting, curling, and streak, but no calico. Numerous plants with rolled leaves of the purple top type and typical calico were found among the varieties Casa Blanca and Salamanca in 'seed'-producing fields at Puno (12,500 ft.). An assortment of varieties in Indian plots at Cuzco (10,600 ft.) showed a high degree of degeneration and 100 per cent. virus infection, mostly purple top, stunting, and leaf roll.

This high incidence of virus diseases in the 'seed'-producing areas of Peru necessitates an immediate study of their exact nature. It is recommended that selection should be undertaken in several regions, where only one variety is grown in a field. The production of an 'improved potato' by selection of apparently healthy plants, which will serve later as basic material for careful selection of healthy tubers for foundation stock, must be initiated at once. Furthermore, the original Peruvian 'seed' should not be replaced by 'seed' from abroad, and work on developing new varieties by crossing species and varieties of *Solanum* must be continued.

Thijn (G. A.). **Methods used in evaluating Potato seedlings.**—*Euphytica*, 5, 1, pp. 55–62, 4 figs., 1 diag., 1956. [Dutch summary.]

A survey is made of the way in which virus-free potato clones raised in the greenhouse in the Netherlands from first-year potato seedlings are evaluated in subsequent years [*R.A.M.*, 34, pp. 668, 670] in field plots. Although strict precautions are taken to prevent virus infection at all stages of testing the most promising seedlings are subsequently tested alone for susceptibility and sensitivity to various viruses. The fact that some seedlings are wholly or partially virus-infected becomes evident during the second year in spite of the destruction of the haulms early the previous year, and these plants are removed as early as possible in the course of bi-weekly inspections. During the third year plants showing virus symptoms are again rogued at an early stage and the foliage of a half-plot (nine plants) removed towards mid-July. Data on resistance to viruses and on growth and yield on different soil types are obtained by planting six tubers of all third-year seedlings near Wageningen in an area where virus diseases are liable to occur frequently. The extent of virus attack is taken into consideration in assessing the fourth-year seedlings.

Zadina (Mme J.) & Beránek (J.). Вирусные болезни Картофеля в зависимости от климатических условий. [Virus diseases of Potato in relation to climatic conditions.]—За сощ. сельскохоз. Науку, Сер. A (*Socialist. agric. Sci., Czechoslovakia*), Ser. A, 4, 4, pp. 389–398, 5 graphs, 1955. [English and German summaries.]

Studies in Czechoslovakia on the occurrence of [unspecified] virus diseases of potatoes [cf. *R.A.M.*, 33, p. 620] in relation to the weather conditions (data concerning which were obtained from the Meteorological Station of the Scientific Research Institute of Potato Cultivation at Havličkov Brod) showed that warm, dry summers, such as 1947 and 1952 are followed by an increase in virus incidence and numbers of insect vectors in the following season.

Steineck (O.). **Anatomische Änderungen im Bau der Wurzel blattrollkranker Kartoffelpflanzen.** [Anatomical changes in the root structure of leaf roll-diseased Potato plants.]—*PflSchBer.*, 15, 5–6, pp. 78–87, 4 figs., 1955. [English summary.]

The author reports an investigation at the Institute for Soil Culture, Vienna, into the structure of rootlets of potato plants with leaf roll virus. Using the varieties Sieglinde and Ackersegen, grown in nutrient solutions in quartz sand, he found that rootlets from infected plants had a wider cortex, smaller steles, and markedly fewer and smaller vessels than healthy ones.

Thomson (A. D.). **Heat treatment and tissue culture as a means of freeing Potatoes from virus Y.**—*Nature, Lond.*, 177, 4511, p. 709, 1 fig., 1956.

In view of the fact that Aucklander Short Top, the most important potato variety grown in New Zealand, is completely infected with potato viruses X and Y [*R.A.M.*, 32, p. 334], efforts were made at the Crop Research Division, Lincoln, to eliminate them from selected tubers by heat treatment. Tubers with sprouts 1 to 2 cm. long formed in darkness were put in incubators maintained at 35° or 38° C. for varying periods, after which the terminal 5 mm. of each sprout was detached and surface-sterilized with a 25 per cent. solution of commercial sodium hypochlorite, and transferred to White's medium containing 0·7 per cent. agar plus pantothenic acid. The rooted plantlets were then potted in John Innes compost and tested for viruses at least twice by sap inoculation to *Datura stramonium* and White Burley tobacco. If virus Y symptoms failed to develop the plants were reinoculated with a severe strain to test for the presence of mild strains.

In another experiment sprout tips were established in the greenhouse and later incubated at 35°. Some new etiolated growth which developed was recovered in culture after removal.

In most cases the heat-treated tubers failed to germinate and all those that did were infected with X and Y. However, of 80 apices detached, 27 survived for testing. All of these gave a virus X reaction but 11 which did not react for virus Y can now be regarded as free from that virus.

Deshmukh (M. J.) & Howard (H. W.). **Field resistance to Potato blight (Phytophthora infestans).**—*Nature, Lond.*, 177, 4513, pp. 794–795, 1956.

The authors, working at the Plant Breeding Institute, Cambridge, showed that the leaflet-disk method [*R.A.M.*, 32, p. 446] for detecting infection by *Phytophthora infestans* in potato leaves measures the probability of producing sporangiophores per unit area, rather than probability of becoming infected [loc. cit.]. Ackersegen, for example, sometimes contained hyphae but produced no sporangiophores. At other times it produced fewer sporangiophores, and these one day later, than Arran Pilot. The length of the incubation period of the fungus in the leaflets and the number of spores produced are regarded as important features distinguishing susceptible from field resistant varieties.

Hooker (W. J.). **Foliage fungicides for Potatoes in Iowa.**—*Amer. Potato J.*, 33, 2, pp. 47–52, 1 fig., 1 graph, 1956.

The author reports trials over the period 1946–52 in which common copper fungicides (Bordeaux mixture, tribasic copper sulphate, and copper zinc chromate) were compared with new organic fungicides (notably zineb and maneb) with respect to potato yields and extent of defoliation [*R.A.M.*, 29, p. 638]. The variety Cobbler was used, grown in peat potato soil at the Agricultural Experiment Station, Ames, Iowa. The extent of defoliation was estimated by the method of Horsfall and Barratt [25, p. 39]. When Bordeaux mixture was applied regularly there was some evidence of a fall in yield. In 1948, 1949, and 1952 in particular yields were lower

with Bordeaux mixture, though the foliage protection was approximately equal to that of the other fungicides.

Trace elements in fungicides may affect tuber production: in 1949 yields from plots sprayed with maneb were significantly higher than those from the other plots, though both early and late blights [*Alternaria solani* and *Phytophthora infestans*: 35, p. 119] were of minor importance during the season, and the increase was apparently due to the manganese in the spray. The yield increases following maneb and zineb treatment in the other years of the trial are attributed chiefly to the fungicidal protection achieved.

Webb (R. E.) & Bonde (R.). **Physiologic races of late blight fungus from Potato dump-heap plants in Maine in 1955.**—*Amer. Potato J.*, 33, 2, pp. 53–55, 1956.

In 1954, a year of heavy *Phytophthora infestans* attack in Aroostook County, Maine, several fields of the variety Kennebec [*R.A.M.*, 33, pp. 216, 685], which is highly resistant to, if not immune from, the common race (0) [33, p. 251] of the fungus, showed slight to moderate infection by mid July. This indicated that a more virulent physiologic race, or races, of the fungus were present early in the season, originating in all probability from diseased tubers discarded at the previous harvest.

In June 1955 a survey of potato dumps was initiated to determine the incidence of the Kennebec race (1) and other races in diseased tubers. Infected plants from 15 heaps yielded 11 races of the fungus, 10 of the 15 samples being mixtures of two or more races. Race 0 was found alone in only one sample, while races pathogenic to Kennebec were present in 11. In view of these findings the authors recommend adequate spraying for Kennebec and other varieties resistant to or immune from race 0 only.

Köhler (E.). **Zur Kenntnis der Sexualität bei Synchytrium.** [Information on sexuality in *Synchytrium*.]—*Ber. dtsch. bot. Ges.*, 69, 3, pp. 121–127, 1956.

The author reports a study at the Biological Institute, Berlin-Dahlem, into the nature of the zoospores of *Synchytrium endobioticum*. He considers that when these are released from the summer sporangia in potato tubers at the normal time they are as a rule sexually neutral, but that with age they mature to become first male gametes and later female gametes. In support of this view he cites his observation that over-ripe sporangia produce zoospores whose movements betray male characteristics. In addition it is usual to find, in such over-ripe sporangia, that one or two fusions have occurred, giving rise to biflagellate spores. This is in agreement with the work of Kusano [*R.A.M.*, 9, p. 542].

Oswald (J. W.). **Experiences in California with the control of common scab of Potato.**—*Meded. LandbHogesch. Gent*, 19, 3, pp. 340–352, 2 figs., 1954.

In this paper, read at the Sixth Annual Crop Protection Symposium at Ghent [? in 1953], the author describes work done in California from 1948 to 1952 on the control of potato scab (*Streptomyces* [*Actinomyces*] *scabies*) [*R.A.M.*, 32, p. 587]. The problem has two aspects: (1) to bring heavily infected land back into production and (2) to prevent the spread of infection. Control at present depends on the acidification of the soil where practicable, an application of sulphur being recommended where 3,000 lb. or less per acre suffice to lower the soil reaction to pH 4·8. In experiments over five seasons scab infection (expressed as a percentage of the tuber surface) was consistently lowest and yields of marketable tubers highest where 2,500 lb. sulphur was applied in 1948, the treatment being normally effective for three years, or longer if potatoes are alternated with an acid tolerant crop [loc. cit.].

In California chemical 'seed' treatment with corrosive sublimate, hot or cold

formaldehyde, or certain organic compounds such as semesan when the seed is to be planted in clean or lightly infected soil is valuable but has clearly no value whatever when tubers are planted in infested soil.

Applications of pentachloronitrobenzene (either 150 or 300 lb. per acre) broadcast on or disked into the soil prior to planting reduced the percentage of the surface scabbed from 37·8 and 19·12 to 6·64 and 0·04 in two trials, respectively. The development of a resistant variety of the long white potato which is used throughout the region is regarded as essential. It has been found in rotation trials that soy-beans grown as a cover crop markedly inhibit the increase of scab in land cropped continuously with potatoes.

Elarosi (H. M.). **Sporulation of fungi inside the plant host cell.**—*Nature, Lond.*, 177, 4510, pp. 665–666, 2 figs., 1956.

At the Department of Cryptogamic Botany, Manchester University, pimple-like outgrowths were formed on stored potato tubers attacked by *Rhizoctonia* [*Corticium*] *solani* and *Fusarium solani* together, caused by the enlargement and division of parenchyma cells below the cork layers. Later *F. solani* invaded the pimples from internal infections and sporulated abundantly in the enlarged cells, forming both macro- and microconidia. The conidia so formed were significantly smaller than those produced in culture on potato dextrose agar.

Pantyuhina (Mme L.) & Chubova (Mme A.). Определение устойчивости сортов Картофеля к бактериальным заболеваниям. [Determination of resistance of Potato varieties to bacterial diseases.]—Земледелие [*Zemledelie, Moscow*], 3, 12, pp. 82–84, 1955.

At the Rusinovicheskaya Vegetable-Potato Selection Station, U.S.S.R., methods were developed for inoculating potato varieties to determine their resistance to bacterial diseases. Seed tubers were inoculated at the bud stage or during full germination with the black leg organism [*Erwinia phytophthora*: *R.A.M.*, 35, p. 219] by grafting into the root collar region either a cutting or injured tissues from a diseased plant, the latter being sprinkled with soil, or inserting a pulped mass of infected tissues, the last-mentioned being the most effective. Resistance to ring rot [? *Corynebacterium sepedonicum*: 34, p. 167; C.M.I. map No. 20] was tested by spraying the eye region of tubers, previously kept in cool storage, with a bacterial suspension prepared on the day of planting by adding pieces of infected tubers to water.

The varieties Rusinovichesky and Minsky were resistant to both the diseases, contracting no infection in either haulms or tubers. This method of testing varietal resistance is recommended for use on experimental plots or at selection stations. When planting susceptible varieties the use of cut seed-tubers should be avoided.

Robinson (D. B.) & Hurst (R. R.). **Control of Potato black-leg with antibiotics.**—*Amer. Potato J.*, 33, 2, pp. 56–59, 2 figs., 1956.

Working at the Science Service Laboratory at Charlottetown, Maine, the authors studied the use of antibiotic treatments against black leg (*Erwinia atroseptica*) in potatoes [*R.A.M.*, 34, p. 742]. In Maine severe attacks usually result from seed infection, but wound infection of the haulms at mid-season is also of importance.

With agristrep and AS–15 agricultural streptomycin (100 p.p.m. streptomycin) as an instant dip for seed pieces, infection was reduced from 28·5 per cent. in the untreated to 1 per cent. or nothing. Semesan bel was less effective and neomycin sulphate of no use.

At their sixth week the haulms were sprayed with streptomycin (100 p.p.m. at 80 gals. per acre). The stems were inoculated five days later by inserting splinters of wood previously soaked in bacterial suspension. The result was a percentage

disease index of 19·8 in the sprayed plants as opposed to 43·7 in the controls, the effect of the spray being apparent in the smaller lesions on treated plants rather than an absence of infection.

HILDEBRAND (E. M.). **Sweetpotato internal cork virosis indexed on Scarlett O'Hara Morning Glory.**—*Science*, 123, 3195, pp. 506–507, 1 fig., 1956.

In extensive tests since 1954 at the Plant Industry Station, Beltsville, Maryland, Scarlett O'Hara morning glory (*Ipomoea bona-nox* × *I. hederacea*) was demonstrated to be a remarkably good indexing host for the sweet potato internal cork virus [cf. *R.A.M.*, 34, pp. 84, 175, 747]. The method of transmission used was a modification of the Yarwood technique [33, p. 203] employing the freshly cut edges of leaf and necrotic root tissue. The squeezing action of a pair of flat-tipped tweezers forced virus extract out on to the wounded, buffer-carborundum-coated leaf surface, the virus being exposed for only a fraction of a second before entering the leaf tissue. Scarlett O'Hara grows very quickly, sometimes unfolding a leaf a day. Symptoms appear on the younger leaves, usually well above the inoculation site. The incubation period is from 7 to 15 (generally 8 to 11) days. The first symptom is a vein-banding mottle; the leaves often remain small and develop a variable chlorotic aspect. Most infected plants are somewhat dwarfed, but blossom and produce apparently virus-free seed.

DIENER (U. L.). **Field control of Sweetpotato stem rot in Alabama.**—*Plant Dis. Reptr*, 39, 12, pp. 918–921, 1955.

From 1952 to 1954, inclusive, plot experiments were carried out at horticultural substations near Clanton and Cullman, Alabama, to test the value of chloranil (48 per cent.) and dichlone (50) both at 2 oz. per gal., captan and PCNB (pentachloronitrobenzene), both at 75 per cent. and 1 oz., semesan bel at 1·6 oz., and nabam (75 ml. per gal.) as dip treatments of sweet potato sprouts for the control of stem rot (*Fusarium oxysporum* f. *batatas*) [*F. bulbigenum* var. *batatas*: *R.A.M.*, 34, p. 103] in naturally infected soil, using the Porto Rico variety. All the treatments except PCNB reduced disease incidence in some years, but yield increases were not always related and the effectiveness of the fungicides varied with environmental conditions. In drought years yield differences did not occur, probably because growth was limited by lack of water rather than number of plants. The toxicity of semesan bel and nabam in late plantings, resulting in reduced stands and stunted sprouts, was probably related to low moisture and high temperatures at planting time.

In varietal trials, Allgold and Goldrush showed marked resistance both at Clanton (16 and 4 per cent. infection, respectively, compared with 76 per cent. for Porto Rico) and at Cullman (7, 4, and 42 per cent.).

YAMADA (W.) & YAMAMOTO (H.). **Studies on the stripe disease of Rice plant. I. On the virus transmission by an insect, Delphacodes striatella Fallen.**—*Spec. Bull. Okayama Prefect. agric. Exp. Sta.* 52, pp. 93–112, 1955. [Japanese, with English summary.]

At Okayama Agricultural Experiment Station, Japan, rice stripe virus was acquired by its leafhopper vector, *Delphacodes striatella* [*R.A.M.*, 30, p. 539], after feeding for one hour on infected plants; the latent period was seven to 14 days and the test feeding period ten (rarely three or five) minutes. Infected females were able to pass on the virus to their offspring.

RUSHDI (M.) & JEFFERS (W. F.). **Effect of some soil factors on efficiency of fungicides in controlling Rhizoctonia solani.**—*Phytopathology*, 46, 2, pp. 88–90, 1956.

Studies are reported from the Division of Plant Pathology, University of Mary-

land, on the influence of seven soil factors on the control of two strains of *Rhizoctonia* [*Corticium*] *solani* from carnation and lucerne, respectively, by solutions of puratized agricultural spray, dithane D–10, vancide 51, and actidione, as determined by linear growth in glass tubes of soil with an originally high clay content.

Soil texture exerted a significant effect, as indicated by decreased growth of the pathogen with rising proportions of white sand up to 90 per cent. The activity of all the fungicides except actidione was enhanced by adjustment of the soil acidity from pH 4·6 to 7·1. The admixture of 1 per cent. starch with the soil reduced the toxicity of dithane D–10, puratized, and vancide 51 (to the lucerne isolate only), but did not affect actidione. Casein at a concentration of 1 per cent. was without influence on the efficiency of the fungicides. Dithane D–10 and puratized were less effective in the presence of 1 per cent. clover hay or wheat straw, while 5 per cent. clover hay impaired the activity of all the chemicals except vancide 51.

None of the moisture-levels (10·5, 15, and 19·5 per cent.) modified the efficacy of treatments, and neither did an increase in soil temperature from 21° to 30° C., though linear growth of the fungus in soil free from fungicides was promoted by the latter factor.

These results are interpreted as indicating that soil texture, hydrogen-ion concentration, and organic matter content may be involved in the regulation of the adsorptive capacity of the soil, probably the principal factor affecting the reactions of fungicides.

Molybdenum in plant and animal nutrition.—*Soil Sci.*, 81, 3, pp. 159–258, 14 figs. (8 col.), 2 graphs, 1956.

The following papers in this useful symposium, edited and introduced by F. E. Bear, deal with the functions of molybdenum [*R.A.M.*, 34, p. 749; 35, p. 233] in relation to agriculture indicated by their titles: symptoms of molybdenum deficiency in plants (pp. 159–171) by E. J. Hewitt; molybdenum deficiencies in legumes in Australia (pp. 173–182) by H. J. Anderson; molybdenum deficiency in horticultural and field crops (pp. 183–190) by P. R. Stout and C. M. Johnson; molybdenum deficiencies in the United States (pp. 191–197) by E. J. Rubins; role of molybdenum in plant nutrition (pp. 199–208) by H. J. Evans; and molybdenum content of alfalfa [lucerne] in relation to deficiency symptoms and response to molybdenum fertilization (pp. 237–242) by H. M. Reisenauer.

A collective list of 392 references is appended.

Horner (C. E.). **Control Peppermint diseases.**—*Sta. Bull. Ore. agric. Exp. Sta.* 547, 16 pp., 11 figs., 1 diag., 1955.

This publication is a guide to the recognition and control of peppermint diseases, of which *Verticillium* wilt (*V. albo-atrum*) [*R.A.M.*, 34, p. 63] has caused serious losses in Michigan and Indiana since 1924, but was only found in Oregon in 1944. The recent outbreak of rust (*Puccinia menthae*) [33, p. 50 *et passim*] on peppermint in Oregon probably originated from wild mint [*Mentha* spp.]. Root rots, which accompany nematode damage and other forms of root injury, are best controlled by rotations every four to six years with nematode-resistant crops for three years.

Minor diseases include powdery mildew (*Erysiphe cichoracearum*), leaf blight, due to a species of *Cephalosporium* which invades rust spots or wounds, resulting in a blackening of the leaves especially under humid conditions, and black stem rot, caused by an as yet unidentified fungus that attacks the stems in cool, wet weather.

Pathology Section.—*Proc. (eighth) Congr. int. Soc. Sug. Cane Tech., Barbados, 1953*, pp. 851–955, 28 figs., 1 graph, 5 maps, 1954. [Received June, 1956.]

In a paper on the relationship between varietal yield deterioration and ratoon

stunting disease [*R.A.M.*, 35, pp. 328–329] N. J. King and D. R. L. Steindl (pp. 851–862) gave a general account of the disease in Queensland and the symptoms by which it may be recognized. It has not been possible, yet, to demonstrate the virus serologically or by the electron microscope.

G. Orian (pp. 862–876) discussed the distribution and probable origin of the gumming disease (*Xanthomonas vasculorum*) of the sugar-cane and strains of the bacterium with special reference to Mauritius [31, p. 537] and showed evidence that the disease there had passed to the cane from the native palm *Dictyosperma album* [20, p. 381; 27, p. 234], rather than having originated from Brazil, as hitherto believed. Another possible source of origin was in *Thysanolaena* grass [loc. cit.] from India or China, but this was considered unlikely. P. B. Hutchinson and J. R. Robertson gave an account (pp. 877–884) of leaf scald disease (*Xanthomonas albilineans*) on sugar-cane in British Guiana. P. B. Hutchinson gave a preliminary note on a bacterium suppressing growth in sugar-cane. The organism had been found on isolation plates of *X. albilineans* in British Guiana. Inoculated into cuttings it either suppressed germination or killed the canes soon after, the number of shoots being reduced to 80 per cent. and the length to 70 per cent.

A new leaf scorch disease of sugar-cane in Formosa caused by *Stagonospora sacchari* [34, p. 257] was described by T. T. Lo (pp. 886–891). It caused a loss of sugar amounting to 1·58 per cent. in Co. 290. Spread may occur throughout the year. The widely planted COX is very susceptible and the more resistant N.Co. 310 has been recommended to replace it. Repeated removal of the leaves from young canes helped to check the disease; at harvest the remainder should be ploughed under. J. W. Hes gave a short account (pp. 891–894) of 'sembur', a leaf spot disease of sugar-cane in Java, which at present appears to be of little importance and seems to be of a virus nature. Affected leaves show a pattern (as if syringed) of white or yellowish spots 2 to 10 mm. long and 1 to 3 mm. broad, which may become reddish. The spots differ clearly from sugar-cane mosaic virus, and to a lesser degree from sugar-cane streak virus. Infection was obtained when 2 ml. of infected sap was poured into the leaf funnel or injected into the highest node.

A general account of the history and present status of sugar-cane diseases in the Caribbean was given by R. E. D. Baker, E. B. Martyn, and G. C. Stevenson (pp. 895–902); the diseases of the crop in Paraguay were described by L. A. Alvarez (pp. 902–907); and G. M. Reyes contributed some postwar observations on those in the Philippines (pp. 907–910). In Paraguay the chief diseases are mosaic virus [C.M.I. map No. 299] and smut (*Ustilago sacchari*) [No. 79], but these are of less importance now that P.O.J. 2878, TUC. 2645, and other resistant varieties are used. In the Philippines Fiji disease [No. 17] and mosaic disease viruses are widespread, particularly the latter. Yellow spot (*Cercospora koepkei*), normally of little account, became serious at the end of 1949 [*R.A.M.* 34, p. 184]. A severe outbreak of sooty mould [cf. 18, p. 56] occurred in the La Cariota district in 1946, following insect attacks in dry weather.

E. V. Abbott gave an account of his investigations of the tolerance of dilution and heat of six strains of the sugar-cane mosaic virus, already noticed [35, p. 489]. Red rot (*Colletotrichum falcatum*) [*Glomerella tucumanensis*] of sugar-cane [35, p. 329 *et passim*] in the Florida Everglades was described by B. A. Bourne (pp. 915–924); C. A. Hughes discussed (pp. 924–936) this disease as it occurs in Queensland [34, p. 677]; and M. A. Wahid, R. J. Steib, and S. J. P. Chilton gave a short account (pp. 936–939) of the use of fungicides to reduce the occurrence of red rot infection in stalks of standing cane in Louisiana. Dusting with 10 per cent. parzate was more effective than tri-basic copper.

The life history of the causal organism of leaf blight of sugar-cane in Formosa, *Cercospora taiwanensis* [14, p. 396], was described by W. Y. Yen and C. C. Chi

(pp. 939–944) together with a description of the perfect state of the fungus, *Leptosphaeria taiwanensis* n.sp., which they had obtained. The perithecia were amphigenous, spherical to ovoid, and 89·27 to 178·53 by 81·1 to 146 μ. the majority being 113·6 to 162·3 by 97·38 to 113·7 μ; the asci were hyaline, straight or slightly curved, and 62·16 to 114·8 by 21·2 to 32·8 μ, majority 75·48 to 78·72 by 23 to 29·5 μ; the ascospores were oblong-fusiform, slightly curved, 3- (rarely 4-) septate, constricted at septa, brown, and 39·4 to 46 by 6·6 to 12·5 μ, majority 41·3 to 44·3 by 11·5 to 12·5 μ.

Stem gall development on the sugar-cane variety 44-3098 in Hawaii, following insufficient soil moisture, was described by C. A. Wisner (pp. 945–951). D. R. Steindl (pp. 952–955) gave an account of *Sclerospora* disease (*S.* ? *macrospora*) [34, p. 107] of sugar-cane in Queensland.

Resolution 5 of the second plenary session of the conference (p. 985) stated that the standing committee on sugar-cane diseases and their world distribution had prepared provisional lists of these but considered further revision desirable before publication.

Reyes Núñez (R.). **Estudios preliminares sobre la pudrición roja de la Caña de Azúcar en el valle del Cauca.** [Preliminary studies on red rot of Sugar-Cane in the Cauca Valley.] —*Acta agron. Palmira*, 5, 1, pp. 51–65, 2 figs., 1955. [English summary.]

The author summarizes the literature concerning sugar-cane red rot (*Physalospora* [*Glomerella*] *tucumanensis*), stating that it is widespread in Colombia [C.M.I. map No. 186] but that growers consider it of minor importance. Inoculation experiments with ten varieties in the laboratory and field with conidial suspensions of the fungus showed that the early varieties [unspecified] were the most susceptible, and the lower internodes more so than the upper. Field infection was consistently associated with attack by *Diatraea* spp. From an examination of the weight of 100 healthy and 100 diseased internodes from first and fifth ratoons of the variety P.O.J. 2878 from two mills in the Cauca Valley, loss of sugar from combined attacks amounted to 8·03 per cent. for the first ratoon and 1·35 for the fifth. No perithecia were observed in the field.

Messiaen (C. M.). **Sur quelques anthracnoses des plantes cultivées.** [On some anthracnoses of cultivated plants.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 6, 3, pp. 285–299, 11 figs., 1955.

Studies at the Centre of Agricultural Research for the South-West, Pont de la Maye, Gironde, France, on certain characters common to various species of *Colletotrichum* and *Gloeosporium* causing anthracnoses of plants in south-western France are described. The fungi studied were *C. graminicola* from maize, *C. lagenarium* from melon, *C. lindemuthianum* from beans [*Phaseolus vulgaris*], *G. fructigena* [*Glomerella cingulata*] from apples, *C. phomoides* from tomato, and *C.* sp. from *Cattleya* sp. The work covered common morphological and cytological characters, conidial germination, the appressoria-chlamydospores, infection, parasitism, specificity, behaviour in culture, variation, and the effects upon the fungi of various common fungicides.

The author suggests 'appressoria-chlamydospores' for the structures which appear to function sometimes as appressori and sometimes as chlamydospores. It was established that *C. graminicola* could be seed-transmitted. Strains of those fungi which tended to become mycelial after some time in culture could be maintained in a sporulating condition by using spore masses in their best condition as inoculum in sub-culturing, especially if oatmeal agar were used.

Fungicide tests on young cantaloupe and bean plants artificially inoculated with *C. lagenarium* and *C. lindemuthianum*, respectively, demonstrated that these fungi

are remarkably resistant to copper products and sulphur. None of the products tested was fully effective against *C. lagenarium*, but only 1 per cent. infection (number of lesions) followed treatment with 0·15 per cent. manganese ethylene bisdithiocarbamate (0·1 per cent. active); next came 0·2 per cent. zineb with 3 per cent. infection, and 0·2 per cent. dichlone with 5 per cent., the last causing a slight burning. Against bean anthracnose all these and ferbam, thiram, ziram (all at 0·2 per cent.), and captan (1 per cent.) gave complete control.

Adequate seed infection, but with good germination, was secured by wounding beans at the end opposite the radicle and treating with a spore suspension under partial vacuum.

The evidence obtained showed that *Colletotrichum* species and some species of *Gloeosporium* form a highly homogeneous group in which the most important of the characters studied (uninucleate spores, formation of appressoria-chlamydospores, behaviour in culture, and resistance to copper products) are probably common to the whole group. These characters are sufficiently specific to give these fungi a place apart among the Ascomycetes.

Ciferri (R.). **Preliminary list of noteworthy diseases of cultivated plants in continental eastern China.**—*Plant Dis. Reptr*, 39, 10, pp. 785–792, 1955.

A list is given, based on information obtained during a visit to China in 1954, of the diseases (bacteria, fungi, virus, and deficiency) of cultivated plants in continental China [*R.A.M.*, 27, p. 159; 32, p. 580] compiled from data obtained in the fields and markets with supplementary notes from herbarium material. Diseases are noted under host common names, listed alphabetically.

The most serious or frequent diseases are reported to be apple stem canker (*Valsa mali*), pear canker (*Diaporthe ambigua*), *Cercospora beticola* [C.M.I. map No. 96] on beet and sugar beet, *Plasmodiophora brassicae* [No. 101] on cabbage and related crops, *Glomerella gossypii* [No. 317] on cotton; *Xanthomonas citri* [No. 11] and *Phytophthora* spp. on citrus, *X. vesicatoria* [No. 269] on [chilli] pepper and tomato, *Piricularia oryzae* [No. 51] and *Sclerospora macrospora* on rice. *Exobasidium vexans* [No. 45] common on tea in the rainy season, and various virus diseases and deficiency disorders. Also worthy of note are *Pyrenopeziza medicaginis* [No. 141] and *Helicobasidium purpureum* [No. 275] on lucerne, *Sclerotinia trifoliorum* [No. 274] on clover, *X. malvacearum* [No. 57] on cotton, *Cladosporium cucumerinum* [No. 310] on cucurbits, *Colletotrichum linicola* [No. 159] and *Fusarium lini* [No. 32] on flax, *Erwinia amylovora* [No. 2] in several localities on pear, *Spongospora subterranea* [No. 34] on potato, *Ustilago kenjiana* (of increasing importance in Manchuria) on sorghum, *Ceratostomella* [*Ceratocystis*] *fimbriata* [No. 91] and *Monilochaetes infuscans* [No. 246] on sweet potato, *X. rubrilineans* [No. 39] (localized and unimportant) on sugar-cane. *Pseudomonas angulata* [No. 321] on tobacco, and *Corynebacterium michiganense* [No. 26] on tomato.

Yukawa (Y.) & Katumoto (K.). **List of fungi ; collected in Oosima-gun, Yamaguti Prefecture (I).**—*Bull. Fac. Agric. Yamaguti Univ.* 5, pp. 311–318, 3 figs., 1954.

This list comprises 76 fungi of all groups collected in Yamaguti Prefecture, Japan.

Baker (Shirley D.). **Additions to the rust fungi of New Zealand, II.**—*Trans. roy. Soc. N.Z.*, 83, 3, pp. 453–463, 2 figs., 1956.

By this further contribution [cf. *R.A.M.*, 25, p. 365] the number of Uredinales recorded for New Zealand is increased to 162, including one new species and some new host records. Among the records of economic interest are *Puccinia antirrhini* on *Antirrhinum* [34, p. 18], which has become widespread in Auckland and is also

recorded from Nelson, Blenheim, and Christchurch; *P. cynodontis* on *Cynodon dactylon*; and one record each of *P. porri* on onion and shallot, and of *Uromyces scillarum* on *Scilla campanulata*, neither of which has apparently become established.

Baker (R. E. D.). **Species of the genus Parodiopsis found in Trinidad.**—*Mycol. Pap. Commonw. Mycol. Inst.* 58, 16 pp., 11 figs., 1955. 4*s.* 6*d.*

Twelve of the 25 known species of *Parodiopsis*, most of which are rare or very local in distribution, with little tendency to spread, are found in Trinidad forests. Only *P. stevensii* on *Inga* spp. is at all common.

Dale (W. T.). **New species of Uredinales from Trinidad.**—*Mycol. Pap. Commonw. Mycol. Inst.* 59, 11 pp., 11 figs., 1955. 4*s.* 6*d.*

The author describes 11 new species of rusts found in Trinidad, and in some cases also collected in neighbouring islands [cf. *R.A.M.*, 30, p. 489].

Schmitt (J. A.). **The host specialization of Erysiphe cichoracearum from Zinnia, Phlox, and cucurbits.**—*Mycologia*, 47, 5, pp. 688–701, 1955.

This is a full account of studies already noticed from another source [*R.A.M.*, 34, p. 108].

Subramanian (C. V.). **Hyphomycetes—I.**—*J. Indian bot. Soc.*, 35, 1, pp. 53–91, 18 figs., 1 pl., 1956.

In this series the author proposes to record, describe, or discuss Hyphomycetes in general, with particular reference to those occurring in India. Included in this part are 12 new species and two new combinations. *Exosporium arecae* is recorded on living leaves of *Areca catechu* in Madras, Bombay, and Assam and *Stigmina maculata* on living leaves of *Ficus* sp. in Mysore.

Four new genera are proposed. *Lomachashaka* is based on *L. kera* n.sp., collected on dead leaves of *Cocos nucifera* at Madras University. *Paathramaya* is based on a new stilbaceous fungus, *P. sundara*, collected by the author on dead stems in the Narsapur forest, Hyderabad. *Prathoda saparva* n.gen., n.sp., another stilbaceous fungus, also on dead stems, was found in the same area. *Tharoopama*, in the Phaeostilbaceae, has for its type species *T. trina* n.sp. on dead grass stems at the University.

Shaw (C. G.). **Additions to the downy mildews (Peronosporaceae) of the Pacific Northwest—II.**—*Northw. Sci.*, 29, 2, pp. 76–83, 1955.

The additional records of Peronosporaceae included in this paper raise the number known to occur in the Pacific Northwest [*R.A.M.*, 32, p. 281] to 54 on 209 hosts. A record of *Peronospora antirrhini* on *Antirrhinum majus* in Washington extends the known geographical range [C.M.I. map No. 222] of this pathogen. It is concluded that the single record of *Plasmopara viticola* on vine in the Pacific Northwest is a most unlikely one.

Baldacci (E.), Spalla (C.), & Grein (A.). **La classificazione delle specie di Actinomyces (Streptomyces).** [The classification of species of *Actinomyces* (*Streptomyces*).]—*Ann. Microbiol., Milano*, 6, 1–2, pp. 41–50, 1954. [English and German summaries. Received October, 1955.]

This is an Italian version of a paper already noticed from another source [*R.A.M.*, 34, p. 488].

Steere (R. L.). **Purification and properties of Tobacco ringspot virus.**—*Phytopathology*, 46, 2, pp. 60–69, 4 figs., 2 diags., 1 graph, 1956.

At the Virus Laboratory, University of California, Berkeley, the infective entity

of tobacco ring spot virus was concentrated and purified [*R.A.M.*, 35, p. 50] from the sap of tobacco, petunia, squash, and cowpea plants by the emulsification of one volume of sap with two volumes of a cold 1:1 mixture of n-butanol and chloroform; separation of the emulsion into three layers by centrifugation; removal and storage of the top layer at 22° C. for 12 to 16 hours; and three cycles of differential centrifugation.

Purified preparations from all four hosts consisted of suspensions of uniform polyhedral particles, averaging 26 mμ in diameter and often appearing hexagonal in electron micrographs of frozen dried samples. Crystals were obtained by the storage at 4° of a suspension of 20 mg. or more virus per ml. in 0·1 or 0·01 M phosphate buffer at pH 7 or in 0·01 N sodium chloride.

Ultracentrifugal analysis of the purified preparations mostly revealed two components, one of which, with a sedimentation constant of 116 S [cf. 19, p. 47], constituted 95 to 99 per cent. of the total solid material and was associated with infectivity. The sedimentation constant of the other (non-infective) component was 89 S.

The nucleic acid content of the purified samples was estimated at 34·4 per cent. [loc. cit.]. Up to 45 mg. purified virus was yielded by 1 l. sap from infected cotyledons of Caserta squash plants. It was infectious at a concentration of 0·005 mg. per ml. and proved capable of inducing on black-eye cowpea leaves one local lesion for every 120,000 particles in the inoculum, determined by the spray-drop method of Backus and Williams (*J. appl. Phys.*, 21, pp. 11–15, 1950). No protein fraction was obtained from the purified sap of healthy plants.

Preparations of the tobacco mosaic, tomato bushy stunt, southern bean mosaic, and turnip yellow mosaic viruses purified by the same procedure were satisfactory for producing monodisperse suspensions for electron microscopy and were infectious.

Lauffer (M. A.), Trkula (D.), & Buzzell (Anne). **Mechanism of inactivation of Tobacco mosaic virus by X-rays.**—*Nature, Lond.*, 177, 4515, p. 890, 1956.

Studies in the Department of Biophysics, University of Pittsburgh, Pennsylvania, on the inactivation of tobacco mosaic virus [*R.A.M.*, 35, p. 331] indicated that the lethal action of X-rays may be the breaking of a single molecular chain anywhere in the nucleic acid. An important deduction from the findings in this paper is that the biological activity of the virus depends on the physical integration of the nucleic acid. Evidence has already been obtained that a comparable degree of integration of the protein is not required [34, p. 489].

Jeener (R.). **Influence of thiouracil incorporation in the ribonucleic acid moiety of Tobacco mosaic virus on its multiplication.**—*Biochim. Biophys. Acta*, 13, pp. 148–149, 1 graph, 1954.

In further experimental work at the Laboratory of Animal Physiology, University of Brussels [cf. *R.A.M.*, 35, p. 345 and following abstracts] the author showed that when 10 to 12 per cent. of the uracil present in the ribonucleic acid moiety of tobacco mosaic virus was replaced by thiouracil [cf. 34, p. 754] and the solution used to infect tobacco leaves, the newly formed virus contained a concentration of infective particles smaller by 28 to 92 per cent. than that from leaves inoculated with unadulterated virus. The author suggests that the thiouracil, while not able to inhibit the multiplication of all the units of each virus particle, reduces the proportion capable of duplication in the host, thus lowering but not inhibiting infectivity.

Jeener (R.), Lemoine (P.), & Lavand'homme (C.). **Détection et propriétés de formes du virus de la mosaïque du Tabac dépourvues d'acide ribonucléique et non infectieuses.** [Detection and properties of forms of Tobacco mosaic virus

devoid of ribonucleic acid and non-infectious.]—*Biochim. Biophys. Acta*, 14, pp. 321–334, 5 figs., 2 graphs, 1954.

This is a more detailed account of work at the Laboratory of Animal Physiology, University of Brussels, abbreviated accounts of which have already appeared (*Arch. int. Physiol.*, 60, p. 547, 1952; 61, p. 427, 1953) [*R.A.M.*, 32, p. 514 and preceding and next abstracts]. Tobacco plants systemically infected with tobacco mosaic virus were found to contain two non-infectious proteins immunologically related to the virus but containing no ribonucleic acid. The electrophoretic mobilities of these proteins and of the virus weré all different. The protein molecules were very small, readily aggregating into particles similar in shape to the virus and crystallizing at pH 3·4 [cf. loc. cit.] into identical fine needles. They were not found in leaves infected directly.

The authors advance the hypothesis that the protein portion of plant viruses is synthesized separately from the nucleic acid portion and that they come together only when the particles are completely formed and become infectious. If, however, the soluble antigens are considered as precursors of the virus it is difficult to understand how they appear in the infected leaf following the virus and accumulate in the leaves in highly advanced systemic infections. The following supplementary hypothesis is therefore put forward: at the initiation of virus development the protein and nucleic portions synthesize in harmony and the two precursors unite as fast as they are formed. When the host cell metabolism becomes modified owing to virus accumulation, the synthesis of the protein portion takes precedence over the nucleic acid and the accumulation of non-infectious proteins results.

Casterman (C.) & Jeener (R.). **Sur le mécanisme de l'inhibition par la ribonucléase de la multiplication du virus de la mosaïque du Tabac.** [On the mechanism of the inhibition by ribonuclease of the multiplication of Tobacco mosaic virus.]—*Biochim. Biophys. Acta*, 16, p. 433, 1955.

In further studies at the Laboratory of Animal Physiology, University of Brussels, tobacco leaves were subjected for ten minutes to infiltration *in vacuo* by a 0·01 per cent. solution of crystallized ribonuclease (GBI). Some hours after the surface of the leaves had been washed and the water in the intercellular spaces removed by transpiration, the epidermis was rubbed with a 1 per cent. solution of tobacco mosaic virus [see preceding abstracts]. During the next few days no sign of virus multiplication was observed. When, however, the leaves were inoculated a few hours before the infiltration, multiplication occurred at the usual rate, even when the concentration of the ribonuclease solution was 20 times that used in the earlier experiment. When the leaves were immersed for one hour in the ribonuclease solution, washed, and inoculated, the virus multiplied at the normal rate. The same results were obtained with leaves of *Nicotiana glutinosa*. Though two hypotheses that may account for these results are briefly discussed, the authors are doubtful of their correct interpretation.

Brandes (J.). **Elektronenmikroskopische Nachweis von Pflanzenviren in ihren Wirtszellen.** [Electron-microscope demonstration of plant viruses in their host cells.]—*Naturwissenschaften*, 42, 4, p. 101, 3 figs., 1955.

At the Institute for Agricultural Virus Research, Brunswick, Germany, the examination under a Zeiss EM 8/2 electron microscope of sections of tobacco leaves inoculated six weeks earlier with tobacco mosaic virus and fixed in a buffered osmic acid solution revealed an irregular distribution of the virus in the tissue. Besides obviously virus-free cells there were some containing only a few rods and others completely filled with virus particles, mostly aggregated lengthwise and shorter than the normal length of 280 to 300 mμ. The bulk of the virus appeared in the form of cell inclusions consisting of a dense conglomeration of aggregated

particles, as described by Black *et al.* [*R.A.M.*, 29, p. 438], which are presumably identical with the X-bodies [see next abstract] discernible under the light microscope. Köhler's observation of the predominance of the virus in the pale zones of diseased leaves [34, p. 702] was confirmed. Neither the characteristic inclusions nor rod-shaped particles were detected in comparable sections of healthy material.

Only in the epidermal cells of tobacco leaf sections inoculated with potato bouquet virus [34, p. 245; 35, p. 481] could the spherical bodies of the virus be demonstrated. Here they occurred in such masses as to present the appearance of a purified preparation.

[An expanded account of these studies appears in *Phytopath. Z.*, 26, pp. 93–106, 10 figs., 2 graphs, 1956.]

Skotland (C. B.), Hagedorn (D. J.), & Stahmann (M. A.). **Electron microscopy of Tobacco mosaic virus in situ.**—*Phytopathology*, 45, 11, pp. 603–607, 3 figs., 1955.

The electron-microscopic study at the Departments of Agronomy, Plant Pathology, and Biochemistry, University of Wisconsin, of ultra-thin cell sections of Havana 38 tobacco leaf tissue infected by tobacco mosaic virus revealed extensive disintegration of the chloroplasts and release of their contents, including grana, into the cytoplasm. The rod-shaped particles of the virus were generally observed in regions containing grana, suggesting an association between the latter and virus production [cf. *R.A.M.*, 23, p. 163]. There were no apparent differences between the nuclei of diseased and healthy tissue. Two dark, granular structures resembling X-bodies [see preceding abstract] were detected, one of them near the virus particles.

Schönfelling (H.) & Broda (E.). **Der Einbau von Radiokohlenstoff in Tabakmosaik verschiedenen 'Alters'.** [The incorporation of radioactive carbon in Tobacco mosaic of various 'ages'.]—*Mh. Chem.*, 85, 1, pp. 33–37, 1954.

An account of this work at the Chemical Laboratory, University of Vienna, on tobacco mosaic virus in tobacco has been noticed from another source [*R.A.M.*, 34, p. 753; see also next abstract].

Passler (F.) & Schönfeld (T.). **Zur Bestimmung der Radiokohlenstoffverteilung in Proteinen. (Versuche an Tabakmosaikvirus.)** [Determination of the distribution of radioactive carbon in proteins. (Experiments with Tobacco mosaic virus.)]—*Mh. Chem.*, 86, 1, pp. 88–97, 1955.

Labelled tobacco mosaic virus [see preceding abstract] was obtained by allowing infected tobacco leaves to photosynthesize carbon dioxide labelled with C14. The protein fraction was hydrolysed and its constituent amino acids obtained by elution chromatography. Examination of the radioactivity of the amino acids showed that they received only a small percentage of the labelled carbon dioxide taken up by the virus, only serine, alanine, and asparaginic and glutaminic acids showing appreciable activity.

Chamberlain (D. W.). **Pathogenicity of Pseudomonas tabaci on Soybeans and Tobacco.**—*Phytopathology*, 46, 1, pp. 51–52, 1956.

In cross-inoculation tests at the Illinois Agricultural Experiment Station, Urbana, with six isolates of *Pseudomonas tabaci* from tobacco and six from soybean [*R.A.M.*, 29, p. 586], the former were consistently more pathogenic than the latter on their own hosts. Soy-beans were generally more severely attacked by isolates from the same host, but the differences were less marked than with tobacco. The erratic behaviour of all the isolates on soy-bean, in contrast to the uniformly high pathogenicity of those from tobacco on their own host, indicates that *P. tabaci* is a less virulent primary parasite on soy-bean than on tobacco.

Diachun (S.) & Valleau (W. D.). **Reaction of some species of Nicotiana to Tobacco mosaic virus, Tobacco streak virus, Pseudomonas tabaci and Phytophthora parasitica var. nicotianae.**—*Bull. Ky agric. Exp. Sta.* 618, 12 pp., 1954. [Received 1955.]

The results of studies at the Department of Agronomy, Kentucky University, on the susceptibility of 48 *Nicotiana* species to tobacco mosaic, streak, wildfire (*Pseudomonas tabaci*), and black shank (*Phytophthora parasitica* var. *nicotianae*) [*R.A.M.*, 33, p. 119; 35, p. 493] are presented in tabular form.

With tobacco mosaic, inoculated by rubbing the leaves with virus suspension, mottling was the dominant symptom in 17 species. In eight species local necrosis led to systemic necrosis. Local necrosis without systemic infection [21, p. 308] was noted in *N. gossei*, *N. nesophila*, *N. stocktoni*, *N. suaveolens*, *N. undulata*, and *N. velutina*.

Most species were susceptible to streak virus [27, p. 65; 29, p. 438] inoculated by rubbing. *N. glauca*, however, and possibly *N. raimondii*, *N. maritima*, and *N. gossei* showed promising resistance.

Inoculation with wildfire was performed by spraying a 24-hour broth culture, diluted 1 in 1,000, on the lower leaf surfaces, or by pouring it over the surfaces after watersoaking. Most species were susceptible but *N. alata*, *N. longiflora*, *N. plumbaginifolia*, *N. repanda*, *N. arentsii*, and *N. bonariensis* were resistant, though some of the plants developed a few spots.

Seedlings were inoculated with black shank by pouring a suspension of zoospores and mycelial fragments into the seed pots. Only *N. alata*, *N. bonariensis*, *N. longiflora*, *N. nudicaulis*, *N. plumbaginifolia*, and *N. repanda* were immune under the conditions of the experiment.

Person (L. H.), Lucas (G. B.), & Koch (W. J.). **A chytrid attacking oospores of Peronospora tabacina.**—*Plant Dis. Reptr*, 39, 12, pp. 887–888, 1955.

In studies by the Agricultural Research Service, United States Department of Agriculture, and University of North Carolina sessile sporangia produced on oospores of the tobacco blue mould fungus (*Peronospora tabacina*) [*R.A.M.*, 33, p. 505; 35, p. 492] used for inoculum were identified as a species of *Phlyctochytrium*. The fact that this and other chytrids may attack the oospores and prevent their germination could partly explain the occurrence of only scattered foci of infection in a plant bed.

Holdeman (Q. L.) & Burkholder (W. H.). **The identity of barn rots of flue-cured Tobacco in South Carolina.**—*Phytopathology*, 46, 2, pp. 69–72, 1 fig., 1956.

Two distinct soft rots of ripe tobacco leaves tend to accompany wet weather during the early colouring stages of curing in South Carolina, one caused by *Pythium aphanidermatum* [cf. *R.A.M.*, 30, p. 511; 32, p. 177] and the other by *Erwinia aroideae* [32, p. 448; 33, p. 18]. They are readily differentiable in the initial phases by the patterns of discoloration and decay induced, that of the fungus being more or less uniform and spreading into the lamina as rapidly as through the veins, while the bacterium attacks the veins first and later extends into the leaf blade, leaving islands of yellow tissue. Both pathogens were easily isolated and gave positive results in inoculation experiments.

The identification of *E. aroideae* was based on its morphology, cultural and physiological characters, and cross-inoculation experiments, in which potato tubers, carrots, cauliflower, lettuce, onion bulbs, celery, and ripe tomato fruits proved to be highly susceptible. The taxonomy of the organism is briefly discussed.

Stephen (R. C.). **Control measures for Tobacco diseases.**—*Inter. Rep. Tob. Res. Bd Rhod. Nyasald* 4, 24 pp., 14 figs., 1955.

This publication sets out in popular form the latest information on tobacco diseases in Rhodesia and their control. The common diseases in seed-beds, the field, and the curing barn are covered, together with some of less account, all of which have been noted previously in this *Review* [*R.A.M.*, 18, p. 483 *et passim*]. A diagnostic chart is included for identification of the diseases.

Lucas (G. B.). **The cardinal temperatures and pH response of Thielaviopsis basicola.**—*Mycologia*, 47, 6, pp. 793–798, 1 graph, 1955.

In studies at North Carolina State College, Raleigh, isolates of *Thielaviopsis basicola* from Kentucky, Wisconsin, Virginia, California, and North Carolina, all pathogenic to tobacco, made no growth on oatmeal agar at 8° or 36° C. [cf. *R.A.M.*, 34, p. 309], though all grew well at 22° to 28°, the average optimum being about 26°. In buffered potato-dextrose broth the Virginia, Wisconsin, and Kentucky isolates made no growth below pH 3·3 or above pH 7·2, the optimum range being between 3·9 and 6·2 [cf. 10, p. 762]. In a buffered synthetic medium corresponding pH values for the Wisconsin and North Carolina isolates were 3, 8, and 4 to 6·4. When excess calcium was added to either medium the mycelial mat weights were greater over the entire pH range than they were in the basal medium.

Mysterious disease causing considerable damage.—*Fmg in S. Afr.*, 32, 1, pp. 53–54, 75–76, 5 figs., 1 graph, 1956.

A serious disease known as 'varingblaar' (fern leaf) or 'tarentaal' (guinea-fowl) disease has recently begun to affect tobacco in South Africa, chiefly in the Rustenburg area. It is also known in America but is far less serious. The symptoms, consisting of numerous brown specks chiefly on the basal leaves but sometimes on all of them, become evident only after curing. There are some indications that the disorder is of physiological origin, possibly connected with weather conditions. The cold, rainy weather towards the end of 1955 may have increased susceptibility.

Reusse (W.) & Zaubitzer (R.). **Physikalische Möglichkeiten zur Prüfung der Chrom-Arsen-Tränkung von Masten.** [Physical possibilities for testing the chromium-arsenic absorption of poles.]—*Holz a. Roh- u. Werkst.*, 13, 6, pp. 221–226, 3 figs., 4 graphs, 1955.

Detailed descriptions are given of two methods recently developed at the Telecommunication Technical Central Bureau, Darmstadt, Germany, for assaying the protective efficiency [against wood-destroying fungi] of the impregnation of spruce and pine poles with chromium-arsenic compounds [cf. *R.A.M.*, 21, p. 277].

Radiographs at 30 to 35 kV of sections 10 to 15 mm. in thickness of spruce poles yielded a qualitative general view of the distribution of the chromium-arsenic in the wood. For laboratory studies on the mechanism of penetration the wood should be impregnated with a solution containing some of the chromium component in the form of potassium or sodium chromate with radioactive $K_2\,{}^{51}_{24}Cr_3O_7$ or $Na_2\,{}^{51}_{24}Cr_3O_7$. The distribution of the chromate and therefore also of the arsenate can be determined by the insertion of a miniature counting tube into boreholes of thin sections, or preferably by the measurement, in an apparatus specially devised for the purpose, of the mean radioactivity of the shavings from various zones of the sections.

Determinations of the content of fully impregnated pine poles, etc., may be made by the activation of heartwood borings with neutrons in an atom pile, and examining the whole or part of the sample some days after completion of the process by means of a Geiger counter. From the results of preliminary experiments it appears that a sensitivity to measurement of 1 μgm. of the impregnating compound may be expected.

Thirty-first Annual Report of the Imperial Forestry Institute, 1954-5.—32 pp., University of Oxford, 1956.

In the section of this report [cf. *R.A.M.*, 35, p. 129] dealing with forest pathology (pp. 14–17) reference is made to a study of the causes of failure of Sitka spruce [*Picea sitchensis*] in north-west Europe. Under congenial conditions this species grows fairly rapidly in the first decades after establishment, resulting in an accelerated demand for nutrients and water, and it is in localities where this cannot be met that failure occurs. In the early stages death of the bark near the base of the main stem is common [loc. cit.], allowing ingress of root-infecting fungi.

A number of uprooted trees of conifer species all showed some die-back of the roots, but in Somerset and Devon Douglas fir [*Pseudotsuga taxifolia*] was much less affected than either Sitka spruce or Grand fir [*Abies grandis*], drought crack of the latter seeming to be associated with shallow soil and steeply sloping ground. On deep, compact sand near Oxford *P. taxifolia* showed severe root die-back and symptoms similar to failing Sitka spruce, together with the constant presence of *Fomes annosus*. Trees, however, seldom die; the root system redevelops, clearly indicating the limited pathogenicity of the fungus.

Reports on Forest Research for the years ending March 1952, 1953, 1954.—vi+130 pp., 11 pl., 11 figs., 1953; vi+122 pp., 9 pl., 1954; vi+177 pp., 13 pl., 17 figs., 1955. London, H.M. Stationery Office.

In these reports [cf. *R.A.M.*, 35, p. 556] an account is given by G. D. Holmes and G. Buszewicz of tree seed germination tests at Alice Holt, Surrey, the most profuse fungal growth occurring on bad seed or that which had been stored for long periods or was of slow-germinating species. The fungi reported as most common on all seeds in the first year were *Oedocephalum glomerulosum* and *Penicillium* spp.; *Fusarium* spp. and *Cylindrocarpon* spp. occurred on Douglas fir [*Pseudotsuga taxifolia*], *Trichothecium roseum* on alder and Douglas fir, *Aspergillus niger* on alder and *Robinia pseudoacacia*, *A. flavus* occasionally on the latter, *Botrytis cinerea* (not common) on Norway spruce and *Pinus sylvestris*, and *Rhizopus nigricans* [*R. stolonifer*] on *Thuja plicata*.

In the second year (pp. 14–17) *Chaetomium globosum* and *Stachybotrys atra* (both very common) and *Ascophanus carneus* (common) were added to the list. Among those added in the third year (pp. 2–4) were *C. indicum* [host not specified], *Pestalotia funerea* (on *Pseudotsuga taxifolia*, *Libocedrus decurrens*, and *Pinus pinaster*), and *Memnoniella echinata* (on *Picea sitchensis* and *Larix leptolepis*). The hosts of *C. globosum* are given as *Pinus radiata*, *P. sylvestris*, and *P. laricio* var. *calabrica*, of *A. carneus* the two last-named, *Pseudotsuga taxifolia*, and *Picea sitchensis*, and of *S. atra* the same two pines, *P. sitchensis*, and *R. pseudoacacia*.

The growth of fungi during germination tests still constitutes a serious practical problem. Dressing seeds with fungicide dusts has proved unsatisfactory in practice, as all the materials used slow down seed germination to some extent.

In the second report T. R. Peace (pp. 62–70) discusses the control and avoidance of forest tree diseases from the aspects of quarantine measures, choice of site and variety, adaptation of silvicultural and nursery practices, treatment with chemicals, wound protection, and difficulties of control. In trials to find a means of producing large quantities of *B. cinerea* spores for infection purposes potatoes and bread were found to be the best media. A method successfully used in 1953 for experimentally infecting Douglas fir and Sitka spruce seedlings with *B. cinerea* entailed covering with a hessian shelter for one week and three weeks [? respectively], and then spraying with a spore suspension.

At Bardney Forest, Lincs., and Harling, Suffolk, a locally serious die-back of thicket-stage oak was associated with *Diaporthe taleola*. Resin flow from patches of dead tissue on or at the base of branches of *Pseudotsuga taxifolia* in Surrey, Kent,

and Gloucestershire appears typical of fungal origin. Several new outbreaks occurred in 1953–4, causing deterioration of the crown and occasional death. A *Cephalosporium* sp. and a *Myxosporium* sp. have appeared fairly consistently in culture, and inoculation experiments with them are in progress. In a general note on diseases of conifers and hardwoods (pp. 31–33, 1954) the same author also mentions die-back of *Picea omorika* at Bedgebury, Kent. Inoculations with *Rhizosphaera pini*, the most commonly occurring fungus on the needles of affected trees, proved negative. A locally serious attack on coppice chestnut at Bramshill Forest by *Cryptodiaporthe castaneae* is suspected to be due to bad growing conditions. Grafting material from Holland of elms resistant to *Ceratostomella ulmi*, but not yet released generally, is to be tested under conditions of heavy natural infection. The same author states (pp. 144–148) that losses among *Thuja* spp., caused by *Keithia thujina*, are often so high as to suggest that it may become uneconomic to plant them. The fungus has been recorded as actively fruiting as early as 11th April and as late as 5th November. Infection is especially bad in nurseries with *Thuja* hedges, suggesting that infection of the newly raised plants comes from near at hand.

Nurseries where *Thuja* is raised from seed in situations well isolated from existing plantations and individual trees are often free from the disease, as for example the Tullialan nursery, Fife, still free after many years of raising *Thuja* from seed. Since 1948 attempts have been made to produce clean stocks from seed in 11 supposedly isolated nurseries. Up to March, 1954, six had become infected with *K. thujina*. In two, *Thuja* trees were discovered nearby, in another the failure was due to an accident, and the three remaining failures are being investigated.

On pp. 100–101 (1953) S. D. Garrett describes the work on soil sterilization [30, p. 591] continued by H. C. Smith, who studied the growth of *Pythium ultimum* inoculated into soils which had been treated with formalin and in which the resultant microflora was dominated by *Trichoderma viride*. Contrary to expectation the fungus, the development of which was followed microscopically and by periodic plantings of cress and turnip seedlings, was most active and survived longest in soils in which the dominance of *T. viride* was most pronounced, namely acid soils treated with full strength formalin. This is not yet fully understood but evidence was produced that *P. ultimum* is sensitive to the antagonism and competition of certain soil bacteria, particularly certain Gram-positive bacteria, which are themselves sensitive to formalin treatment and to the antagonism of *T. viride*. This would support the conclusion that the natural biological control exerted by the microflora of untreated soils is greater than that in partially sterilized soils. In consequence, strict precautions must be taken against the invasion of partially sterilized soil by pathogens, at least in the early stages of microfloral recolonization.

Ida Levisohn (pp. 102–103) reports further work [32, p. 108] on the rhizospheres of trees. Roots of Scots pine growing down into water leached from 'pseudomycorrhizal' soil develop forking and pronounced pseudomycorrhizal infection. Roots growing into leached water from 'mycorrhizal' soil showed profuse branching but no infection. In order to determine whether reduced aeration was a factor limiting the growth of mycorrhizal mycelia or the formation of a mycorrhizal association, the leached water from a 'mycorrhizal' soil in which pine roots were growing was aerated during the summer and autumn. There was profuse forking, but still no root infection. There was complete lack of forking in leachings from various soils when the seedlings were grown in partially sterilized potting soil.

In the third report (pp. 50–52) the same author records that birch seedlings (*Betula verrucosa*) growing under very favourable conditions received a stimulus from the rhizosphere activity of *Boletus scaber*. *Thuja plicata* in sand cultures inoculated with mycelium from mycorrhiza of Lawson's cypress [*Chaemacyparis*

lawsoniana] grew better than controls. Trees under a heather mulch on Wareham Heath developed tuber mycorrhiza of a typical ectotrophic type in addition to the characteristic endotrophic infection.

G. A. Townrow (pp. 118–120, 1953) describes studies on the mode of entry of *Cryptostroma corticale* [31, p. 304] into the bark of sycamore [*Acer pseudoplatanus*], a supply of spores being obtained from twigs inoculated by inserting them in a 3 per cent. malt agar culture of the fungus after surface sterilization. In the absence of nutrient 50 per cent. spore germination occurred after three days at 20° C. and 100 per cent. humidity; on 3 per cent. malt agar germination occurred after 24 hours. At 10° growth was one third that at 25° (when growth is most vigorous both in culture and on cut twigs), while spore germination and germ-tube growth were feeble. At 5° no germination had occurred after 7 days.

Using a method based on that of Brooks and Moore [3, p. 278], it was established that spores, wet or dry, are not drawn down into the vessels from the ends of cut shoots. They germinate on the surface and the tubes grow down, the hyphae growing much more readily in the non-lignified tissues, though the xylem walls are penetrated by fine hyphae. Germination and penetration were rapid on fresh wounds, even if the atmospheric humidity were less than the minimum, and occurred on older wounds if moist, but not on dry ones.

In naturally infected trees staining was regularly present. This faded after the death of the tree, but might persist for two years. *C. corticale* was present in the stained wood, usually in association with other fungi, commonly *Trichoderma viride* and *Fusarium* spp. Two inches outside the stain, in clean wood, *C. corticale* could be isolated alone. If present in the main stem it rarely grows out into side branches while they are still living. Growth from an infected side branch into the main stem appears to be more common. The fungus, with the stain, can be traced into the root system, and it has been isolated from roots 1·5 mm. in diameter.

On pp. 57–58 (1954) N. F. Robertson reports the continuation of Townrow's work by himself and Helen Purnell. In a trial of three methods for the experimental inoculation of cut ends of the main shoot of sycamore seedlings it was found best either to dust the cut with spores and then enclose in a 4 by 1 in. specimen tube, sealing the neck with cotton wool, or to apply a suspension of spores to the cut, afterwards enclosing in a tube in the same way. In many cases although infection was recorded it was limited to the dead wood between the cut and the node immediately below. The fungus was found spreading, without staining, from the dead snag into the living wood in two cases.

D. M. Griffin found (pp. 52–53, 1954) that when Sitka spruce seedlings were grown in glasshouse containers in a variety of old and 'sick' nursery soils, heavy damping-off occurred in Kennington Old soil (from Kennington Nursery, Oxford), and less in Kennington Three and Ringwood (Nursery soil, Hampshire). Potentially pathogenic *Pythium* spp. [cf. below, p. 648] were isolated regularly from killed root tips. The only other pathogen detected was *Fusarium oxysporum*.

J. G. Manners reports that at the conclusion of the experiment on the inoculation of larch [34, p. 6], 35 of the 52 trees inoculated with *Trichoscyphella willkommii* became infected and few of the cankers healed. Only three of the 36 trees inoculated with *T. hahniana* developed cankers and these healed. Of European larch strains Polish ones were the most resistant [loc. cit.]; Japanese larch was markedly resistant.

Caroselli (N. E.). **Bleeding canker disease of hardwoods.**—*Sci. Tree Top.*, 2, 1, pp. 1–6, 2 figs., 1953. [Received June, 1956.]

To date the bleeding canker disease (*Phytophthora cactorum*) [*R.A.M.*, 27, p. 502] has been found to affect six species of maple (*Acer*), five of oak, two of birch, one of lime (*Tilia*), horse chestnut, sweet gum (*Liquidambar styraciflua*), and willow.

Trees bark-traced over a 12-year period in an effort to control the disease exhibited lateral spread and twig die-back. Heavy feeding encouraged disease spread in the host tissues and caused untreated chronic cases to become acute. Since 1939 many thousands of trees have been injected successfully with carosel (a mixture of helione orange and malachite green) [21. p. 394], which neutralizes the toxin produced by the pathogen. Studies to determine the terminal growth response of infected hardwoods injected in 1940 showed highly significant differences when the trees were injected only or fed also. Terminal twig growth in untreated diseased trees decreased by about one half over the test period (1936–41).

Waterman (Alma M.). **Septoria canker of Poplars in the United States.**—*Circ. U.S. Dep. Agric.* 947, 24 pp., 7 figs., [? 1955].

This circular covers the history, symptoms, hosts, distribution, and control of poplar canker in the United States caused by *Septoria musiva* [*R.A.M.*, 33, p. 510]. The disease affects hybrid poplars, susceptibility varying according to parentage [25, p. 426]. The perfect state, *Mycosphaerella populorum* [20, p. 386], is found on fallen leaves in which pycnidia may also overwinter, both ascospores and conidia from these sources causing reinfection in the spring. Cankers may develop rapidly and on susceptible hosts young stems are girdled in one growing season. Secondary fungi soon infect tissues damaged by the causal organism and tend to mask its presence. Of 202 clones of varying parentage tested for resistance 33 showed no infection, 27 were very slightly susceptible, and 38 highly susceptible. Variations in susceptibility were noted in 51 of the clones. Among 65 clones of the parentage *Populus generosa* × *P. jackii* one was not infected and 61 were slightly to highly susceptible. Clones of *P. trichocarpa* [var.] *hastata* were susceptible. To control the disease mixed resistant clones should be planted, dormant cuttings should be surface sterilized, and spacing arranged to ensure adequate aeration near ground level.

Györfi (J.). **A nyárkéreghalál és a nyárfarák magyarországi Károsítása.** [Damage to Poplars from bark decay and canker in Hungary.]—*Erdész. Kutatás., Budapest.* 3, pp. 105–114, 1954. [English and German summaries. Abs. in *For. Abstr.*, 17, 2, p. 244, 1956.]

Two types of bark decay affecting poplars in Hungary are described. One, ascribed to *Dothichiza populea* [*R.A.M.*, 33, p. 509], appears to be particularly active in the dormant season, attacking chiefly hybrids of *P. marilandica* and *P. robusta*, and also *P. simonii*, *P. nigra*, and its var. *italica* between the Danube and Tisza. The other, probably *Cytospora chrysosperma* [*Valsa sordida*: 33, p. 388; 34, p. 494], occurring in the same region, is characterized by brown, later black staining and attacks chiefly *P. robusta* and *P. marilandica* hybrids and *P. nigra* var. *italica*. Other forms of canker described are those due to *Pseudomonas syringae* f.sp. *populae* [35, p. 560] on *Populus trichocarpa* and hybrids of *P. robusta*, *P. regenerata*, *P. serotina*, *P. berolinensis*, and *P. eugenei*, and also *Nectria galligena*.

Matuo (T.) & Sakurai (Y.). **Notes on the three newly-found diseases of Walnut stems in Japan.**—*Res. Rep. Fac. Text. Seric., Shinshu Univ.*, 4, pp. 9–12, 6 figs., 1954. [Japanese with English summary.]

This paper deals with three diseases of walnut stems recently found in Japan. One, called blight by the writers, is due to a species of *Phomopsis* [cf. *R.A.M.*, 33, pp. 348, 496]; another, caused by *Melanconium oblongum* [*Melanconis juglandis*: 3, p. 310], which is reported in the United States, is named black-granular blight. The third, brown blight, is apparently new, and the causal fungus, *Macrophoma juglandis* n.sp., is described. The pycnidia measure 200 to 235 by 90 to 120 μ, the non-septate, fusiform spores 16 to 28 by 3 to 6 μ, and the hyaline, bacilliform spores, 20 to 30 by 1·5 to 3 μ.

KHAN (A. H.). **A new disease of Mulberry in the forest plantations of the Punjab.** —*Pakist. J. sci. Res.*, 7, 3, pp. 92–99, 11 figs., 1955.

A severe die-back of mulberry in the Khanewal Forest and other plantations in western Pakistan was shown to be caused by *Hendersonula toruloidea* [*R.A.M.*, 35. p. 495], not hitherto recorded in the country. Diseased trees assume a bushy appearance owing to the development near the base of a large number of branches to replace those killed by the fungus. At this stage the tree resembles a large broom or cone. The leaves gradually wither and finally the affected branches die. Water-soaked, brown, slightly depressed areas develop on the stem, and lower down the bark cracks and peels off, leading to the formation of cankers containing powdery, black spore masses which are apparently disseminated by wind. The fungus penetrates the sapwood, inducing a greyish-black discoloration. Infection generally originates in the crown and proceeds downwards, the tree being ultimately girdled and dying slowly. Another local host of *H. toruloidea* is *Melia azedarach*.

Other pathogens of mulberry in Pakistan include *Septogloeum mori* [29, p. 517], *Coryneum mori*, and *Massaria epileuca*.

MATUO (T.) & SAKURAI (Y.). **Hot-water-disinfection of the sapling of the Mulberry tree infected by Rosellinia necatrix (Hart.) Berl. and the situation of the isolation ditch preventing the development of this disease in the Mulberry farm.**—*J. seric. Sci., Tokyo*, 23. 5, pp. 271–277. 5 diags., 1954. [Japanese, with English summary.]

The writers' investigations showed that disinfection of mulberry saplings attacked by *Rosellinia necatrix* [cf. *R.A.M.*, 34. p. 796] can be carried out by hot-water treatment at 45° C. for one hour, or at 47° for 40 minutes. Isolation trenches round diseased trees should include two plants outside the affected plant.

LEAPHART (C. D.) & GILL (L. S.). **Lesions associated with pole blight of Western White Pine.**—*For. Sci.*, 1, 3, pp. 232–239, 3 figs., 2 graphs. 1955. [Received June, 1956.]

During the summer of 1951 and 1952, 60 white pines (*Pinus monticola*) were cut and studied on six selected areas in the Cœur d'Alène, Kaniksu, and St. Joe National Forests in northern Idaho. Fifty-one trees from affected areas showed degrees of pole blight [*R.A.M.*, 35, p. 132], ranging from apparent freedom to advanced infection. Nine healthy trees were included from two areas in the Cœur d'Alène and Kaniksu National Forests where the disease does not occur. The results indicated that typical blight lesions rarely callus, whereas those produced by inoculation with *Leptographium* sp. on healthy trees usually begin to callus within a year. They also suggest that reduced radial growth is consistently associated with pole blight and precedes both crown decline and lesion development. A marked reduction in radial growth of the lower stem usually occurs before crown symptoms appear. Therefore, although lesions are generally associated with pole blighted trees, they are apparently not directly responsible for the progressive decline of diseased trees.

WATERMAN (ALMA M.). **A stain technique for diagnosing blister rust in cankers on White Pine.**—*For. Sci.*, 1, 3, pp. 219–221. 1955. [Received June, 1956.]

The following technique was devised at the Forest Insect and Disease Laboratory, New Haven, Connecticut, for detecting blister rust [*Cronartium ribicola*: *R.A.M.*, 35, p. 84] in cankers on white pine (*Pinus strobus*) in the eastern United States. A block of wood and bark suitable for sectioning on a freezing microtome is cut from a suspect canker, boiled in water until most of the air and resin are removed, submerged in a 10 per cent. aqueous solution of gum arabic for five to ten minutes, and mounted in the solution. Radial sections about 20 to 25 μ thick are stained for

one hour in a modified Pianeze III*b* stain composed of 0·5 gm. malachite green, 0·1 gm. acid fuchsin, 0·01 gm. martius gelb, 150 ml. distilled water, 50 ml. 95 per cent. alcohol, and 1 ml. glacial acetic acid, rinsed, cleared for 10 to 15 minutes, and mounted in clove oil. *C. ribicola* is distinguished from other canker producing or secondary fungi by its wider, intercellular hyphae distinctly separating the medullary ray cells, and conspicuous haustoria which form in the bark cells of newly infected twigs, particularly in the ray cells of bark and wood in older infected areas. The hyphae of *C. ribicola* consistently stain light bluish-red in the advancing tips, bright red in the mature parts, and purplish in the older The small nuclei stain dark red or almost black.

Mülder (D.). **Die Disposition der Kiefer für den Kienzopfbefall als Kernproblem waldbautechnischer Abwehr.** [The susceptibility of Pine to bark blister rust infection as a central problem of silvicultural control.]—*SchrReihe forstl. Fak. Univ. Göttingen* 10, 35 pp., 7 charts, 1955. [Abs. in *For. Abstr.*, 17, 2, p. 244, 1956.]

By assuming original infection of a three-year-old shoot, foci of infection by *Peridermium pini* were counted and dated on 12 trial plots of about 0·25 ha. of seven- to 60-year-old *Pinus sylvestris* stands at Ahlhorn (Oldenburg) and Danneburg (Elbe), Germany [*R.A.M.*, 31, p. 306]. Susceptibility as measured by the age of the first infection and degree of reinfection varied considerably among individuals. Analysis of incidence within the stands showed no significant influence of diseased neighbouring trees or of neighbouring stands. Susceptibility increased from almost nil in trees less than 20 years old to a maximum at about 40 to 50 years. Incidence appeared to be correlated with vigour, and was greatest on the tallest trees in the thicket stage and on the greatest diameter classes in a 33-year-old stand. In provenance trial plots at Trippstadt, trees from Belgium and the Palatinate were the most severely affected, those of Hungarian origin less so. Cutting out infected trees is unlikely to arrest the spread of the disease.

Zak (B.). **Inheritance of resistance to little leaf in Shortleaf Pine.**—*Res. Notes Stheast. For. Exp. Sta.* 88, 2 pp., 1955. [Abs. in *For. Abstr.*, 17, 2, p. 180, 1956.]

One-year-old progeny of six apparently resistant and four moderately diseased shortleaf pine trees [*Pinus echinata*], all open-pollinated, were planted in a heavy clay soil inoculated with *Phytophthora cinnamomi* [*R.A.M.*, 34, p. 196; 35, p. 56] and flooded twice weekly during the growing season. A high percentage of the progeny of five of the former but only a low percentage of the progeny of three of the latter showed signs of good resistance in their root systems.

Keener (P. D.). **Two fungi associated with a microcyclic rust, Coleosporium crowellii Cummins, on needles of Pinus edulis Engelm. in Arizona.**—*Madroño*, 13, 6, pp. 189–195, 4 figs., 1956.

The author reports the occurrence, for the first time, of the association of the hyperparasites *Darluca filum* and *Cladosporium aecidiicola* with teleutosori of *Coleosporium crowelii* on *Pinus edulis* in the neighbourhood of Grand Canyon, Arizona, in 1953 and 1954.

Salisbury (P. J.). **A review of damping-off of Douglas Fir seedlings in British Columbia.**—*For. Chron.*, 30, 4, pp. 407–410, 1954.

Damping-off of Douglas fir [*Pseudotsuga taxifolia*] occurs every year in established forest nurseries in British Columbia but is seldom serious. The fungi concerned are species of *Rhizoctonia*, associated with early losses, *Fusarium*, including *F. oxysporum*, and occasionally *Pythium* [cf. above, p. 645]. Acidity seems to reduce the incidence of damping-off, particularly that caused by *Pythium*. Under

laboratory conditions peat as a planting medium has given satisfactory control, but it cannot be used in the field until some method is found of preventing it from blowing away.

Newly established nurseries experience somewhat heavier losses, but these are reduced with time, perhaps as a result of improvement in soil condition and the practice of giving the seeds a sandy cover.

A 10 per cent. improvement in stand resulted when Bordeaux mixture, semesan, or ferbam was sprayed over the surface of the beds just after the emergence of the seedlings and again 14 days later.

CAREW (J.), HAMSON (A.), & WIEBE (J.). **Vegetable varieties.**—*Cornell Ext. Bull.* 928, 14 pp., 8 figs., 1955.

Amongst the new varieties of vegetables recommended in this publication Empire Danish cabbage is recorded as being resistant to yellows [*Fusarium conglutinans*: *R.A.M.*, 34, p. 581], Harvest Queen muskmelon, resistant to *F.* [*bulbigenum* var. *niveum*: 35, p. 60], and the sweet corn [maize] varieties Golden Beauty and Seneca Super Market, resistant to bacterial wilt [*Xanthomonas stewarti*].

BANGA (O.). **International conference on the improvement of vegetable varieties at Wageningen, Netherlands, on August 26 and 27, 1955**—*Euphytica*, 5, 1, pp. 18–32, 6 figs., 1956. [Dutch summary.]

The following newly developed vegetable varieties were reported at the above conference: the German bean [*Phaseolus vulgaris*] varieties Schreibers Resista Wachs [*R.A.M.*, 32, p. 613] and the Swedish Drabant (wax) are resistant to *Colletotrichum* [*lindemuthianum*: 35, p. 262]; also resistant are the German varieties Schreibers Imuna, Longimuna, and Grandimuna, but they are slightly susceptible to mosaic viruses 1 [bean mosaic virus] and 2 [bean yellow mosaic virus] and to tobacco virus 11 [a strain of tobacco streak virus]. The German pole varieties Haubners Rekord, Olympia, Mansf. Gold, and Wachs Goldr., the Netherlands varieties Fruca, Widusa, Aromata, Combine, and Romore (the last three pole varieties) and the American varieties Full Measure, Hi-Score, Impr[oved] Tendergreen, Processor, Rival, Topcross, and Topmost are resistant to bean mosaic virus [34, p. 72; 35, p. 60]. The French pea variety Clause 50 and all new varieties recently introduced in the United States are resistant to *Fusarium* wilt [*F. oxysporum* f. *pisi* race 1: 34, pp. 271–272], the German varieties Breustedts Ceres and V. Waverens Juwel to wilt and top yellows [pea leaf roll virus: 34, p. 695 and below, p. 651], and the Netherlands variety Rondo to leaf roll alone. The Canadian tomato varieties Vagabond and Vulcan, the English hybrid Ware Cross, and the Netherlands hybrid Single Cross are resistant to *Cladosporium fulvum*. The Netherlands cucumber variety Esvier is resistant to *C. cucumerinum* [34, p. 510] and the Swedish Favör to *Erysiphe cichoracearum*. The Japanese cabbage Shimoyama-Chitose is resistant to mosaic [virus], the Netherlands spinach variety Presto to blight [? cucumber mosaic virus: 34, p. 426], and the American spinach hybrid No. 7 to *Peronospora spinaciae* [*P. effusa*]. The Japanese radish varieties Tahakura and Hayafutori-Nerima are resistant to mosaic [virus: cf. 34, p. 69], and seven Japanese hybrid watermelon varieties to anthracnose [*Colletotrichum lagenarium*].

KEENER (P. D.). **Virus diseases of plants in Arizona. I. Field and experimental observations on mosaics affecting vegetable crops.**—*Bull. Ariz. agric. Exp. Sta.* 256, 38 pp., 18 figs., 3 diags., 1954.

This bulletin, based on field observations made over many years by past and present members of the Department of Plant Pathology, University of Arizona, and on the results of experiments conducted by the author since 1949, is the first to deal exclusively with virus diseases of vegetables in Arizona [cf. *R.A.M.*, 32, p. 66].

It constitutes a summary of all the relevant information at present available on mosaic viruses attacking vegetables in the State. The subject is treated under the headings: economic significance of plant virus diseases: mosaic symptoms (on leaf, stem, flower, fruit, and root); spread (mechanical, insect, and seed transmission); and control (use of disease-free seed, eradication, sanitation, isolation, insecticides, barriers, resistant varieties, crop-free periods, and other recommendations). In an appendix (p. 37) a table is given showing the vegetable crops grown in Arizona and the mosaic viruses, if any, which attack them.

Further tests on commercial seed stocks of melons [loc. cit.] showed that in 1951 0·6 per cent. of the plants from 313 seeds of M.R. Imperial 45 cantaloupe developed mosaic in the greenhouse and 0·6 per cent. of 16,027 in the field, the corresponding figures for honeydew being 3·4 of 801 and 1·6 of 7,512. In 1952 the greenhouse figures for cantaloupe were 6·1 per cent. of 245, and the field percentage 1·6 of 6,466; honeydew (greenhouse only) gave 7·1 (of 292) and 6·7 (503) per cent. In 1953 (field only) mosaic incidence was 5·3 per cent. in the former (22,489 plants) and 4·5 in the latter (965).

Sulphur-resistant cantaloupe varieties (such as V-1 and SR-91) have fewer virus-infected seeds than the varieties resistant to mildew [*Erysiphe cichoracearum*] like M.R. Imperial 45. It is suspected that seeds of the prevalent wild gourds are virus-infected.

Gallegly (M. E.) & Bishop (C. F.). **Pentachloronitrobenzene for control of club-root of crucifers.**—*Plant Dis. Reptr.* 39, 12, pp. 914–917. 1 fig., 1955.

In plot trials near Davis, West Virginia, pentachloronitrobenzene (PCNB) either mixed uniformly with the upper 4 in. of soil at 80 lb. per acre before planting or concentrated round the plant in the transplant water at 2, 4, or 8 lb. per 100 gals. (½ pint per plant) gave effective control of club root (*Plasmodiophora brassicae*) [cf. *R.A.M.*, 35, p. 255] of cauliflower [33, p. 697] and broccoli. The treated plants developed excellent fibrous roots with only a few small clubs at the extremities and produced normal yields. The cost of treating one acre (12,000 plants) with PCNB at the lowest rate in the transplant water was $15.

Jeener (R.). **A preliminary study of the incorporation in growing Turnip yellow mosaic virus and its related non-infective antigen of labelled amino-acids.**—*Biochim. Biophys. Acta*, 13, pp. 307–308, 1954.

In experiments with the non-infective, ribonucleic acid-free protein in turnip yellows mosaic virus [*R.A.M.*, 28, p. 261 and above, p. 639] radioactive tracers were used to study the differences in radioactivity between the virus and its ribonucleic acid-free antigen, extracted from young infected turnip leaves grown in the presence of carbon dioxide labelled with C^{14} and strongly illuminated by fluorescent tubes. The finding that the specific radioactivity of the antigen was always higher than that of the virus excludes the possibility that the former was a degradation product of the latter; it therefore appears possible that the two fractions of the virus are synthesized independently, uniting during the subsequent formation of virus particles, the ribonucleic acid-free antigen being the protein portion of the uncompleted virus.

Visser (R. H.). **Vergelingsziekte in steklingen en bietenzaadfelden in Groningen.** [Yellows disease in stecklings and Beet seed fields in Groningen.]—Abs. in *Tijdschr. PlZiekt.*, 62, 1, p. 30, 1956.

The falling beet yields in the Groningen district of Holland are attributed, among other causes, to the increase in beet yellows virus [*R.A.M.*, 29, p. 132], and for some years past a number of seed firms, in co-operation with the Institute for Rational

Sugar Production, have carried out investigations on the disease in stecklings and beet seed fields and organized a spray warning service with the aid of aphid traps. From counts made by the Dutch-Swedish Seed Company it is clear that the percentage of infection increases annually with sparse planting, resulting in a widely spaced stand [34, p. 337].

In four experimental fields of the above-mentioned firm planted with severely diseased and reasonably healthy stecklings in tenfold replication, the use of the latter produced a yield increase in 1954 ranging from 6·5 to 10·5 per cent., while the germinability of the seed was 5 per cent. higher. In 1955 there was an increase of 6·5 per cent. in the yield of one of the fields, equivalent to 200 kg. seed in the average total yield of 3,000 kg. per ha.

The recent general improvement in the situation in ascribed in part to the systematic application of aphicides.

HUBBELING (N.). **Resistance to top yellows and Fusarium wilt in Peas.**—*Euphytica*, 5, 1, pp. 71–86, 6 figs., 1956. [Dutch summary.]

The author recapitulates from the literature the symptoms, incidence, economic importance, and host range of pea top yellows (pea leaf roll) virus [*R.A.M.*, 35, p. 144 and above, p. 649] and *Fusarium* wilt (*F. oxysporum* f. *pisi* race 1) [34, pp. 271, 272] in Holland and emphasizes the need for breeding for resistance to these diseases [loc. cit.].

The former is particularly serious in the central and southern districts, where the only susceptible varieties still grown, and those only on a small scale, are the very early varieties Alaska and Venlose Lage de Grace. The reactions of common pea varieties to both diseases are tabulated. The procedure for testing varieties selected for resistance is to sow at the end of April or beginning of May near well-established lucerne or white clover fields between lines of a susceptible variety such as Unica; to transfer [unspecified] aphids to the test plants from a well-established, infested lucerne field, and omit insect control until infection has taken place. Line selection must be continued until susceptible plants cease to segregate out.

Wilt occurs in every province except Zeeland but it is rare in newly formed calcareous polders. Resistant varieties are secured from sowings in uniformly heavily infested soil by repeated back-crossing, or by crossing two resistant varieties. In obtaining varieties resistant to both diseases it is preferable to use leaf roll-resistant parents and select for resistance to wilt. Varieties in this category are Alderman, Big Ben, Small Late Canner, Breustedt's Ceres, Celsior, Climax, Haubner's Diamant, Director, Elf, Gradus, Jubilee, Kelvedon Monarch, Kelvedon Triumph, Koning de Middelvroegen, Koroza, Wisconsin Merit, Morse's Market, Multifold, van Waveren's Juwel, Nova, and Titan, Perfectah, Perfection, Wisconsin Pride, Salzmünder Edelperle, Frühe, and Grüne, Wyola, Sherwood, Improved Stratagem, Giantstride, Dippe's Gelbe Viktoria, Piccolo (Weibull 1541), Zeiner's Kurz und Gut, and Zelka. Several wilt-resistant varieties are tolerant of yellows.

NATTI (J. J.) & SCHROEDER (W. T.). **Silicones as lubricants for Pea seed protectants.**—*Plant Dis. Reptr*, 39, 12, pp. 909–913, 1955.

At the Department of Plant Pathology, New York State Agricultural Experiment Station, Geneva, coating pea seed with the silicone emulsions LE–45, LE–46, and X–521 (supplied by Linde Air Products Company, Division of Union Carbide and Carbon Corporation, Buffalo, New York) after treatment with orthocide 75 dust, or incorporating the emulsions in slurry preparations of delsan A–D and ortho seed guard eliminated most of the retarding influence of these protectants on the rate of delivery through the grain drill (usually 13 to 15 per cent. less than that of untreated seed). The silicone emulsions alone or in combination with the protectants reduced the germination of the seed and retarded seedling development on

moistened filter paper in enclosed Petri dishes, but had no effect when the seed was sown in soil in the greenhouse and field. The fungicidal and insecticidal values of the dressings were not reduced.

Chamberlain (D. W.). **Methods of inoculation for wildfire of Soybean and the effect of bacterial pustule on wildfire development.**—*Phytopathology*, 46, 2, pp. 96–98, 1956.

In this joint contribution from the United States Regional Soybean Laboratory and the Illinois Agricultural Experiment Station describing comparative tests of six methods of inoculating soy-bean with *Pseudomonas tabacum* [*R.A.M.*, 35, p. 552], wildfire is reported to have developed best in association with bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) [33, p. 64]. The results were equally satisfactory whether the wildfire inoculum was sprayed over pustule-infected leaves or the two organisms were introduced simultaneously with watersoaking. Wildfire infection was also promoted by a previous attack of bacterial pustule or bacterial blight (*P. glycinea*). Watersoaking healthy leaves with inoculum of *P. tabacum* alone produced an erratic pattern of infection. Wounding was ineffectual as a method of inducing wildfire infection, and none developed on healthy leaves, not watersoaked, sprayed lightly with inoculum.

Athow (K. L.) & Caldwell (R. M.). **The influence of seed treatment and planting rate on the emergence and yield of Soybeans.**—*Phytopathology*, 46, 2, pp. 91–95, 1956.

In a four-year trial (1947 to 1950) at the Purdue University Agricultural Experiment Station, Lafayette, Indiana, treatment of low-grade soy-bean seed with arasan or spergon [against unspecified fungi] at the rate of 2 oz. per bush. usually improved emergence and in some tests significantly increased yields [cf. *R.A.M.*, 32, p. 659 *et passim*]. Where the seed was of good quality and accurately spaced by hand, emergence was only slightly increased by treatment and yield scarcely affected, except at the lowest seeding rate (4-in. spacing) when it was still significantly lower than that from untreated seed at 1- to 3-in. spacing. In plots seeded with a conventional grain drill at rates below an average spacing of $1\frac{1}{2}$ in., yields were smaller irrespective of treatment.

It appears from these experiments, conducted under conditions both favourable and adverse to emergence and stand establishment, that treatment is worth while only for poor-quality seed spaced at unduly wide intervals.

Schovecky (A. J.). **A Phytophthora root rot of Soybeans.**—*Diss. Abstr.*, 15, 11, pp. 1991–1992, 1955.

Most of this information concerning an important damping-off and root rot of soy-beans on silty clay soils in north-western Ohio caused by *Phytophthora* sp. has already been noticed from another source [*R.A.M.*, 35, pp. 267, 503]. In greenhouse experiments the variety Monroe was significantly more resistant than Earlyana or strain W9–2024 in sand, loam, or Toledo silty clay; Earlyana was significantly more resistant than W9–2024 in loam and Toledo silty clay, and W9–2024 was more susceptible in clay than in loam or sand. Earlyana was more susceptible in *Phytophthora*-infested clay than in loam. Monroe was significantly more susceptible in loam or sand than in Toledo silty clay but more resistant than Earlyana or W9–2024 at soil temperatures of 15° and 25° C. Blackhawk was more resistant than Lincoln or Harosoy at 15°, 25°, and 35° and Monroe and Blackhawk more susceptible at 35° than at 15° or 25°.

Incidence was less in unsteamed field soil infested with *Phytophthora* than in soil steamed prior to infestation, and was significantly less in the latter when a species of *Fusarium* was added. Of the four soy-bean varieties recommended for Ohio only Monroe was resistant, as was OH–53, a selection from the susceptible Bavender.

Volcani (Zafrira). **Two bacterial diseases of Capsicum annuum and Solanum melongena fruits.**—*Ktavim* (*Rec. agric. Res. Sta.* [*Rehovot*] *Israel*), 4, 2, pp. 5–14, 11 figs., 1956.

The author reports his investigation of two spot diseases of chilli in Israel, one caused by *Bacillus subtilis* and the other by *Erwinia carotovora* [cf. *R.A.M.*, 32, p. 476]. *B. subtilis* also causes a rot of eggplant fruits. Within the range 25° to 37° C. the progress of infection by these organisms was more rapid at the higher temperatures, as it was with *B. polymyxa* [30, p. 10], also causing a spot disease of chilli.

High humidity favoured the progress of infection, particularly with *B. polymyxa* and *B. subtilis*. All three bacteria are wound parasites causing soft rots in chilli and tomato fruits, and in moist slices of various vegetables when inoculated at a relatively high temperature.

Govinda Rao (P.) & Koteswara Rao (D.). **Anthracnose disease on Cyamopsis tetragonaloba, Taub.**—*Sci. & Cult.*, 21, 8, pp. 457–458, 1 fig., 1956.

Severe anthracnose of cluster bean (*Cyamopsis tetragonaloba*) [*C. psoraloides*: *R.A.M.*, 35, p. 268] which occurred in August, 1953 and 1954, at Bapatla, Andhra, India, was caused by *Colletotrichum capsici* [35, p. 396].

Varma (P. M.). **Persistence of yellow-vein mosaic virus of Abelmoschus esculentus (L.) Moench in its vector Bemisia tabaci (Gen.).**—*Indian J. agric. Sci.*, 25, 4, pp. 293–302, 1955.

At the Indian Agricultural Research Institute, New Delhi, it was shown that the virus of yellow-vein mosaic of bhendi (*Hibiscus esculentus*) [*R.A.M.*, 31, p. 6] may persist in the female white fly (*Bemisia tabaci*) [35, p. 282] throughout its life. For this to occur the fly must feed for at least four to six hours on an infected plant, otherwise it retains the virus only temporarily.

Freitag (J. H.). **Beetle transmission, host range, and properties of Squash mosaic virus.**—*Phytopathology*, 46, 2, pp. 73–81, 1 fig., 1956.

Continuing his studies on squash mosaic virus at the Department of Entomology and Parasitology, University of California, Berkeley [*R.A.M.*, 31, p. 368], the writer found the dilution tolerance of the virus in the sap of infected Zucchini plants to be 1 in 1,000,000 and the thermal inactivation point 75° C. It was still active in sap after six weeks' ageing at room temperature and after five years in frozen material.

The species and varieties of Cucurbitaceae reacting positively to mechanical inoculation with squash mosaic virus comprised field pumpkin, *Cucurbita pepo* var. *velopepo*, *C. moschata*, the Hubbard, Delicious, and Banana squash varieties, *C. mixta*, *Lagenaria siceraria*, *Citrullus vulgaris* var. *citroides*, *Cucumis anguria*, 11 cucumber and nine musk-melon varieties, *Trichosanthes anguina*, and *Momordica charantia*. Also susceptible were Spencer sweet peas, Laxton's Progress and Perfection peas, and *Phacelia campanularia*.

The cucumber beetles, *Acalymma trivittata* and *Diabrotica undecimpunctata*, were shown to be capable of transmitting the virus from diseased to healthy squash plants, the former being much the more efficient vector [20, p. 189], but they failed to convey cucumber mosaic virus to squash. Transferred daily to healthy squash plants, infective *A. trivittata* retained the virus for 17 days and *D. undecimpunctata* for 20. An individual of *A. trivittata* infected nine out of 28 healthy squash plants in daily transfers; the virus was acquired after only five minutes' feeding on a diseased leaf after 72 hours' starvation. Regurgitated fluid was found to be highly infectious and is thought to be the most likely source of mosaic in transmission. The virus was also present in an active state in the faeces and was recovered from the blood of beetles previously fed on diseased plants, as well as from their crushed

bodies. Negative results were obtained in transmission tests with nine species of aphids, five of leafhoppers, and two of plant bugs.

Doolittle (S. P.) & Beecher (F. S.). **Effect of streptomycin formulations on angular leaf spot in Cucumber.**—*Plant Dis. Reptr.* 39. 10. pp. 731–736. 1955.

In preliminary greenhouse tests in 1954 at Beltsville, Maryland, it was found that streptomycin was taken up by cucumber leaves and considerably reduced the lesions of angular leaf spot (*Pseudomonas lacrymans*) of cucumber [*R.A.M.*, 31. p. 272]. Terramycin alone was ineffective but agrimycin 100 (a mixture of streptomycin and terramycin) gave good results at strengths greater than 200–220 p.p.m. Used as a protectant on artificially inoculated field plants in 1954 and 1955 three sprays of agrimycin containing 200 p.p.m. streptomycin in two tests and 300 p.p.m. in one were superior to tribasic copper sulphate (3 lb. in 100 gals.) plus tween 20, but the degree of control obtained may not justify commercial use. Three applications of agrimycin (streptomycin at 400 p.p.m.) reduced secondary spread from a heavy infection to a trace. It is possible that where primary infection is light two such sprays may suffice.

Wilhelm (S.) & Stevenson (E. E.). **Verticillium wilt of Melons.**—*Plant Dis. Reptr.* 39. 11, p. 881, 1955.

Verticillium albo-atrum causes repeated losses to melon growers in the San Joaquin Valley of California [*R.A.M.*, 14. p. 283]. Among the susceptible varieties [loc. cit.] are the Crenshaw melon and cantaloupe which, however, yield a small crop. The fungus does not affect the seedlings but the mature plants, especially when a good crop is expected. Outbreaks are most serious on land cropped repeatedly with melons or previously planted with tomatoes. In greenhouse trials all the 18 isolates of *V. albo-atrum* from melon were pathogenic to Pearson tomato.

Gandy (D[oreen] G.). **Stysanus stemonitis in Mushroom houses.**—*M.G.A. Bull., 1955*, 64, pp. 551–552, 2 figs., 1955.

The spores of *Stysanus stemonitis* [cf. *R.A.M.*, 33. p. 501], which was growing profusely on the straw of the compost and on damp bed boards at a mushroom farm in Kent, caused distressing symptoms to those inhaling them, requiring the use of respirators. The symptoms, including shivering, loss of appetite, inflammation of nose and throat, and chest congestion were at first only apparent after day-long exposure, but subsequently caused a reaction in a few minutes.

Sarazin (A.). **The cultivated Mushroom.—12. Evolutionary cycle.**—*M.G.A. Bull., 1955*, 64, pp. 553–561, 5 figs., 1955.

In a further contribution to this series [cf. *R.A.M.*, 34. p. 75] the writer discusses the life-cycle of the cultivated mushroom (*Agaricus campestris bisporus*) [*A. bisporus*], the production of carpophores, and the nuclear mechanism of spore formation. He also discusses the genetics of the cultivated mushroom, including the production of different strains and the manner in which this may occur.

Edwards (R. L.). **About watering.**—*M.G.A. Bull., 1955*, 65, pp. 585–586, 1955.

In a short note on the watering of cultivated mushrooms the author stresses the correlation between the amount of water needed and the very varying air conditions that may prevail in different houses and under different weather conditions. To save time, it is desirable to use a nozzle or rose allowing the maximum application of water per minute with the minimum injury to soil structure or to the mushrooms. Watering little and often may lessen soil breakdown, but may cause discoloration or disease in nearly mature mushrooms. Soil breakdown can be avoided by using peat casings.

Kaufhold (W.). **Krankheiten und Schädlinge on Spalierreben.** [Diseases and pests of espalier Vines.]—*Pflanzenschutz*, 8, 4, pp. 43–44, 2 figs., 1956.

The symptoms of vine mildew (*Oidium*) [*Uncinula necator*] and downy mildew (*Peronospora*) [*Plasmopara viticola*] are described in popular terms, with directions for their control in Bavaria, Germany. The former may be effectively combated by dusting or spraying with wettable sulphur, once before and several times after flowering at three-weekly intervals, and the latter by copper-containing preparations or organic fungicides, e.g., orthocide [captan], polyram, dithane, fuclasin, or phytox, applied simultaneously with the wettable sulphur. Combined dusts, containing copper or an organic fungicide mixed with wettable sulphur, have also become available recently.

Williams (P. H.), Hack (Judith), Ebben (M[arion] H.), Howles (R.), Read (W. H.), Hughes (J. T.), Smith (R. J.), & Messing (J. H. L.). **Plant diseases. Insecticides and fungicides. Chemical investigations.**—*Rep. exp. Res. Sta. Cheshunt, 1953*, pp. 22–31; 41–45; 53–59, 3 pl., 1 graph, 1954. [Received June, 1956.]

In this report [cf. *R.A.M.*, 33, p. 654 and next abstract] P. H. Williams and Judith Hack describe further studies on tomato stem rot (*Didymella lycopersici*) [35, p. 137]. In a glasshouse experiment Potentate tomato plants were grown in soil, with or without stable manure (30 tons per acre). Inoculations were effected by watering the soil with a spore suspension of the fungus. The results showed that the manure did not significantly affect the amount of disease in steamed soil, though when dug in before steaming incidence was slightly lower than in the non-manured plots or those manured after steaming. The addition of [unspecified] soil organisms from unsterilized soil did not lower the incidence of infection. Only about 2 lb. of fruit was infected out of a total yield of 4,432 lb., losses of crop being due to basal and stem lesions caused by *D. lycopersici*, which killed 223 plants. In addition, 13 plants were killed by *Botrytis cinerea* and *Verticillium albo-atrum*, the latter occurring only in unsteamed plots. The crop from steamed, uninoculated plots averaged 63·61 tons per acre, as against 70 to 83 per cent. of this for steamed inoculated soil, and 50·62 tons for unsteamed unmanured and 52·36 for the manured.

Other experimental evidence demonstrated that the fungus can survive in pots of soil in the open or under glass from one season to the next, either as mycelium in the soil or on dead [tomato] roots.

In further tomato root studies P. H. Williams and M. H. Ebben found that the numbers of bacteria and fungi isolated from glasshouse soils by the dilution plate method were not appreciably affected by fallowing, though steaming caused a big drop in the occurrence of *Colletotrichum atramentarium* on the root surface and in the root tissues. Fallowing slightly decreased the prevalence of this fungus early in the season, but by October it was as widespread as in the continuously planted plots.

R. Howles states that in further experiments heat treatment of tomato seeds [34, p. 189] infected with [tobacco mosaic] virus appeared to augment the susceptibility of the progeny to infection, but increased the weight of the seedlings compared with those from healthy, heat-treated seed. Repetition of the heat treatment of arum lily corms [*Zantedeschia* sp.] against [tomato] spotted wilt virus gave inconclusive results and the treatment appears to be of no practical value. In continued experiments on therapeutic treatment of chrysanthemum flower-distorting (mosaic) virus [? tomato aspermy virus: 35, p. 298] out of ten chemicals (additional to the 2,4-D successfully used before) applied to the soil in which potted chrysanthemum cuttings infected with the virus were growing, the most effective was 0·013 per cent. 2-chlorophenoxy-acetic acid, which was not phytotoxic and

which freed the plants (in three out of four groups of five plants each) from the virus. It was realized that if the incubation period for floral symptoms of chrysanthemum mosaic virus to appear were greater than a year, aphid control on plants initially healthy would not be required during the growing period, but mechanical infection of 24 heat-treated Late Delight chrysanthemum plants with the virus on 15th May, 1953, resulted in the appearance of floral symptoms on one plant on 3rd November, 1953.

In laboratory investigations by W. H. Read, J. T. Hughes, and R. J. Smith 1:4-naphthaquinone mono- and di- chloroimides were considerably less toxic to the spores of *Fusarium culmorum* than dichlone, whereas 2-chloro-1:4-benzoquinone dichloroimide and, especially, 2:5-dichloro-1:4-benzoquinone dichloroimide were almost as toxic as dichlone.

In further spraying tests on large tomato plants grown normally in glasshouse borders, 4-amino-2-chlorophenol was less active than previously against leaf mould (*Cladosporium fulvum*) [cf. 34, p. 111]. It produced a marked effect on the older lesions, but failed to eradicate the fungus from recently infected parts, and had a negligible protective action when sprayed at 0·3 per cent.

When young potted cucumber plants infected by mildew (*Erysiphe cichoracearum*) were sprayed with karathane at a range of concentrations plus 0·025 per cent. of a wetting agent containing 60 per cent. dioctyl sodium sulphosuccinate, control was obtained within 18 days by 0·05 per cent. and almost complete control by 0·025 per cent., but with weaker solutions some new growth of mildew occurred. The very slight phytotoxic effect of the 0·05 per cent. solution was no more, if not less, than occurred with the standard copper oxychloride petroleum emulsion spray.

Further trials with a large number of eradicant pastes applied to lesions on tomato stems caused by *D. lycopersici* failed to secure control.

J. H. L. Messing reports the results of further nutrient deficiency experiments with carnations, cyclamen, stock [*Matthiola* sp.], dahlia, lettuce, and tomato, detailing the symptoms produced. As a result of boron deficiency the axillary shoots of William Sim (and to a lesser degree White Maytime and Spectrum) carnations split the leaf at its base and grew through the split.

Williams (P. H.), Hack (Judith), Howles (R.), Read (W. H.), Hughes (J. T.), Smith (R. J.), Massey (D. M.), Winsor (G. W.), & Messing (J. H. L.). **Plant diseases. Insecticides and fungicides. Chemical investigations.**—*Rep. exp. Res. Sta. Cheshunt, 1954*, pp. 24–29; 39–42; 50–54; 59–63, 2 pl., 1956.

In this report [cf. preceding abstract] P. H. Williams and Judith Hack describe further work on tomato stem rot (*Didymella lycopersici*). In a glasshouse experiment using Potentate tomatoes plots treated with 2 per cent. formaldehyde (5 gals. per sq. yd.) where there had previously been a heavily infected crop produced only one plant out of 80 with a basal lesion, but only three plants in the untreated controls became infected. Apparently the removal of the affected plants combined with burying the surface soil during preparation had eliminated almost all infection. When soil was reinoculated after formaldehyde treatment, 26 plants became infected, as compared with 56 on plots steamed and then reinoculated. The addition of the stable manure (30 tons per acre) did not increase the disease, or even a heavier dressing (60 tons). Mulching with maiden loam and pricking this into the surface significantly reduced the number of basal lesions.

R. Howles reports that treatment with hydrochloric acid of tomato seed infected by mild tobacco mosaic virus did not make it virus-free, but when 2 gm. of seed were treated with 16 ml. of 0·04 per cent. 2-chlorophenoxyacetic acid in an open Petri dish, the liquid poured off when germination began, and the seed rinsed, the

treatment almost cleaned the seed of the virus and caused no injury. On the other hand, Cheshunt 5B lettuce seed was not freed from lettuce mosaic virus by the action of 0·02 per cent. chlorophenoxyacetic acid for two days, nor did the chemical eradicate chrysanthemum flower-distorting [? tomato aspermy] virus from infected chrysanthemum cuttings. Healthy Late Delight chrysanthemum plants, inoculated with the virus, again showed flower distortion symptoms in the same season. The application of 100 ml. of 1 per cent. sodium nitrate to the root systems of *Nicotiana glutinosa* plants greatly increased their susceptibility to this virus, hence their value as test plants.

W. H. Read, J. T. Hughes, and R. J. Smith found that of a number of quinoxaline derivatives tested in the laboratory, only those with a hydroquinoid system were fungicidal to spores of *Fusarium culmorum*. In glasshouse trials a number of anilides, 4-chloroanilides, and 2:4-dichloroanilides of salicylic acid and 3:5-dichlorosalicylic acid, were tested against *Cladosporium fulvum* in sprays containing 0·025 per cent. cellophas A as a dispersing and wetting agent. In each test the 3:5-dichlorosalicyl-derivative was more active than the corresponding salicyl-derivative at the same molar concentration. Of the quinoxaline derivatives similarly tested, only 2:3-dimethyl-5:8-dihydroxyquinoxaline showed any marked activity against the fungus, but only in the older lesions. The incompatibility of thiram preparations with petroleum emulsion sprays was established. In further trials on the control of cucumber mildew [*Erysiphe cichoracearum*] 4:6-dinitro-2-*sec*octylphenyl crotonate, in the form of a proprietary wettable powder stated to contain 25 per cent. of the technical compound, gave very good results at 0·01 per cent. active material. When plants were badly attacked, a second application after 10 to 12 days was desirable.

In preliminary investigations into some chemical aspects of tomato 'cloud' or blotchy ripening [cf. 35, p. 493] D. M. Massey and G. W. Winsor found that the condition is associated with a low concentration of organic constituents in the fruit [33, p. 55]. The evidence suggested that whatever the primary cause of the disorder may be, its effect on the fruit is associated with injury in or near the vascular bundles, which probably occurs under certain physical conditions that may operate for relatively short periods, and its extent would seem to be correlated with the general growth of the plant.

J. H. L. Messing reports the results of nutritional deficiency experiments with Goliath and King George hydrangeas. Nitrogen deficiency caused a rapid yellowing of the old leaves with a red pigmentation along the edges, accompanied by premature leaf fall and retarded growth. Small, regular blooms formed (pure blue in Goliath and mauve in King George), which matured earlier than those of the controls. Sulphur and phosphorus deficiencies had little effect. With potassium deficiency, early, acute, interveinal chlorosis developed on the youngest leaves, the areas becoming eventually almost white; growth was markedly and flowering slightly retarded, the blooms of both varieties being pale pink; subsequently a dark pigmentation appeared on the edges of the old leaves of King George. Lack of calcium tended to produce weak and chlorotic plants with pink blooms. In the absence of magnesium the older leaves of King George developed a marginal chlorosis when the blooms were colouring, pink in both varieties, followed by scorch; by the time the blooms matured the foliage was severely affected and many leaves had been shed. On Goliath the symptoms appeared even more suddenly and spread with greater rapidity, mild chlorosis of the leaves being followed by the appearance of irregular, necrotic, interveinal spots, which formed a characteristic ring some distance from the margin. With boron deficiency the youngest leaves were narrow and thick, with a shiny, crinkled surface. The growing points of the weaker shoots died before the flower buds appeared and numerous side shoots developed. The flowers were unevenly mauve in both varieties and were dwarfed and deformed, the

petals being rough and the edges brown and moribund. All plants not supplied with aluminium developed a mild but general chlorosis.

Atti del Convegno Fitopatologico per la Puglia e la Lucania, Bari, 20–22 Maggio, 1955. [Proceedings of the Phytopathological Convention for Apulia and Lucania, Bari, 20–22 May, 1955.]—*Notiz. Malatt. Piante, 1955*, 31–32 (N.S. 10–11), pp. 1–242, 5 pl., 1 graph, 1955.

At this Convention V. Carrante (pp. 23–32) reviewed modern methods of plant disease control with particular reference to the conditions obtaining in Apulia and Lucania, southern Italy, where the losses sustained in 1954 from fungal diseases and insect pests were estimated at 15,525,323,000 lire. He dealt briefly with old and new fungicides, soil fumigants, spraying and dusting apparatus, deficiency disorders, virus diseases, and antibiotics.

R. Pastore, discussing (pp. 33–38) the control of crop diseases in relation to methods of cultivation, drew attention to the condition of almond trees known locally as 'verde secco' or 'dry greenness', which is closely associated with the root rot caused by *Armillaria mellea*. It is becoming increasingly widespread and constitutes a serious menace, destroying whole plantings of almonds, which cannot be reconstituted or replaced by vines or other fruit or olive trees. The serious damage caused to olive trees growing in a damp, low-lying area at Campo Verde, Maglie, Lecce, by *Gloeosporium olivarum* [*R.A.M.*, 35, p. 531] could be corrected by proper drainage.

E. Baldacci discussed (pp. 39–59) modern 'criteria of study' and control methods in relation to the chief fungal diseases of herbaceous and woody plants in the region concerned, the main points dealt with being etiology, climatic factors, cultural conditions, forecasting outbreaks of vine downy mildew (*Plasmopara viticola*) [34, p. 767], new fungicidal products, types of spraying equipment, and seed treatment (which is not yet general in Italy).

G. Sibilia (pp. 61–73) [with English summary] dealt with the chief virus diseases of woody and herbaceous plants present locally, namely, almond mosaic [27, p. 245], fig mosaic [35, p. 622], infectious degeneration of the vine [court-noué: 35, p. 578], tobacco mosaic [30, p. 83, *et passim*], tobacco ring spot and streak, and the 'farfara' complex of the last two viruses with *Pseudomonas tabacum* [33, p. 764].

A. Ciccarone (pp. 165–173) [with English summary] presented biometrical data and the results of cross-inoculation experiments which showed that marked differences exist between populations of *Leveillula taurica* [32, p. 536; 34, p. 407] infecting globe artichoke, tomato, chilli pepper, eggplant, and olive, indicating strain specialization within the species.

A Graniti (pp. 175–180) suggested a spray schedule of Bordeaux mixture and 0·03 per cent. parathion against fungal diseases (mainly *Gloeosporium olivarum*) [see above] and insect pests of olive trees, consisting of one insecticidal spray in September, one combined spray in October, and one fungicidal or combined spray in November.

A. Montaruli (pp. 181–187) presented the results of spraying trials carried out in 1953 and 1954 against *Plasmopara viticola* on vine [35, p. 577] at Taranto to compare materials containing little or no copper with Caffaro powder (16 per cent. copper oxychloride) and Bordeaux mixture (24 per cent. copper sulphate), both at 1 per cent. in water. The average percentages (for the two years) of diseased leaves given by the different treatments, applied in accordance with meteorological data, were: 0·5 per cent. S.R. 406 (containing 50 per cent. captan) 3·99, 0·3 per cent. ditramina (20 per cent. zineb) [33, p. 578] 4·11, Caffaro powder 5·22, 0·3 per cent. cuproexina (30 per cent. zineb) 5·55, Bordeaux mixture 5·83, 0·3 per cent. antiperonosporico A (65 per cent. zineb) 6·11, 0·3 per cent. dithex ramato (60 per

cent. zineb) 7·22, and 0·3 per cent. cuprotan (90 per cent. zineb) 8·88. None of the materials appeared to be injurious and all gave effective control of infection.

S. Proto (pp. 189–191) reported that in 1954 chestnut trees growing in the region of Monte Vulture [Apulia] were attacked by *Endothia parasitica* [34, pp. 346, 759, *et passim*]. The infected trees are to be felled.

Eerste Jaarverslag Proefstation voor de Groenteteelt in de volle grond in Nederland, 1954–1955. [First annual report of the Experiment Station for Outdoor Vegetable Culture in Holland, 1954–1955.]—55 pp., 7 figs., 1 graph, [? 1956].

The following items of phytopathological interest occur in the sections of this report on breeding and varietal investigation (pp. 26–38) and pests and diseases (pp. 46–47). A programme has been initiated for the development of an early potato to replace the very important Eersteling [Duke of York], which is susceptible to wart disease [*Synchytrium endobioticum*] and can only be exported, e.g., to Germany, by special permission. There are already two resistant early varieties, Barima and Doré, but the tubers of the former are less well-shaped than those of Duke of York, while the stolons of the latter are unduly long.

Methods have been developed [*R.A.M.*, 35, pp. 261–262] for the assay of bean (*Phaseolus vulgaris*) seedlings for resistance to anthracnose (*Colletotrichum* [*lindemuthianum*: 35, p. 572]), halo blight (*Pseudomonas* [*medicaginis* f.sp.] *phaseolicola*), the roll mosaic form of *Phaseolus* virus 1 [bean mosaic virus], and *Nicotiana* virus 11 (stipple streak) [tobacco necrosis virus]. To ensure the effective spread of *C. lindemuthianum* the seedlings must be maintained at a temperature of 15° to 22° C. and a relative atmospheric humidity of 100 per cent. for two days after inoculation. For this purpose glass tubes were used, 20 by 3½ cm., containing a filter stopper and 3 cm. water. Five seedlings were introduced and sprayed with a suspension of the fungus, after which the tube was sealed with a plug of cotton wool. The first symptoms appeared five days after transference to the greenhouse. These tests were very successful.

The halo blight tests were also performed in glass tubes, in which the seedlings were inverted and a solution of the bacterium poured over them. In this case sealing is not essential but it helps to prevent desiccation of the roots. After four hours the seedlings were transferred to the greenhouse at 18° to 25°, which proved to be too high. Symptoms began to appear after eight days but the spread of infection was incomplete. Ten days later the plants were reinoculated mechanically with moderately good results.

For the tobacco necrosis virus tests the seedlings were potted directly in sterile vermiculite. After eight days the plants were inoculated by rubbing with infective material, and five days later the first symptoms appeared. The results of these tests were very satisfactory. A similar procedure, used for roll mosaic inoculation, which should be followed, however, by spraying with clean water to assist the spread of the virus, was disappointing.

Work on the breeding of peas is to be discontinued with the conclusion of the current projects. The 'raisin' varieties Eroica and Koroza are included for the first time in the 30th descriptive varietal list of agricultural crops for 1955. Both are resistant to American vascular disease [*Fusarium oxysporum* f. *pisi* race 1: 31, p. 471] and the latter also to top yellows [or leaf roll virus: see above, p. 651].

None of the foreign cucumber varieties tested for outdoor performance combined the essential commercial attractions, e.g., early ripening and long, dark green fruits, with resistance to 'fire' [*Cladosporium cucumerinum*: 34, p. 510] and cucumber mosaic virus. The Czech variety, Mlada Boleslav, however, was heterogeneous in its reactions to the former disease and tolerant of the latter.

Sporulation by *Marssonina panattoniana* [35, p. 573] declines rapidly on stan-

dard media. In a preliminary test the most effective control on endive was secured by spraying with manzate, Hoechst 2659, spray sulphur (jebokil), or captan one or four days before inoculation. In a subsequent field trial 0·3 per cent. captan reduced the incidence of infection from 100 to 19·7 per cent.

Complete control of peppermint rust (*Puccinia menthae*) was effected by 10 minutes' immersion of the rhizomes in water heated to 42°. Spraying [cf. 35, p. 395] with manzate, phygon, and premerge at a dosage of 800 l. per ha., which was recommended to growers in Western Washington, United States, was also undertaken, but the results were unsatisfactory.

Collections of *Lactuca serriola* from different botanical gardens were tested for reaction to lettuce mosaic virus with very divergent results. The predominant response to infection was vein-clearing merging into mosaic. The plants of one collection were destroyed altogether, while those of two others developed foliar necrosis but continued to grow. A Portuguese collection reacted quite abnormally, red spots being formed along the leaf veins and later replaced by a very faint mottling or the entire disappearance of symptoms. In *L. serriola* the virus is not seed-transmissible, but the results of these observations indicate that suitable material should be chosen for use in breeding operations.

ANDERSSON (G.). **Årsberättelse över Sveriges Utsädesförenings verksamhet år 1955.** [Annual report on the work of the Swedish Seed Association for the year 1955.]—*Sverig. Utsädesfören. Tidskr.*, 66, 2, pp. 71–146, 3 graphs, 1956.

The following information of phytopathological interest is presented in this report [cf. *R.A.M.*, 35, p. 154]. Snow mould (*Fusarium nivale*) [*Calonectria nivalis*] was one of the factors contributing to an unusually poor winter wheat stand at Svalöf. Winter rye also sustained heavy damage at the Kolmar branch of the Association; the maximum yields were obtained from the Petkus variety, which was only slightly attacked, followed by Värne. Kungs rye II was severely infected (also in Västernorrland).

Large-scale tests are in progress at Svalöf with Dutch antisera of potato viruses X and S [35, p. 582] with a view to the elimination of infection from seed stocks; during the period under review the material comprised 15,000 plants. Those originating from the few plants tested in 1954 were almost uniformly healthy but the remainder were severely diseased. Scab [*Actinomyces scabies*] was relatively mild on potatoes in Jämtland, but differences in varietal reaction were apparent, the new selections Sv 41127, 42149, and 47068 being less susceptible, e.g., than Up-to-Date and Early Puritan.

The severe summer drought and an intensive outbreak of mildew (*Erysiphe communis*) [*E. polygoni*] were no doubt responsible for the failure of late-ripening spring crucifer varieties at Svalöf.

In Östgöta the tetraploid strains of red clover, Sv 034, U 036, and WR 28, were definitely superior to others in resistance to rot [*Sclerotinia trifoliorum*].

Overseas news.—*Commonw. phytopath. News*, 2, 2, pp. 25–29, 1956.

In a continuation of this series [cf. *R.A.M.*, 35, p. 418] G. C. CHAMBERLAIN reports from Canada that the intensive cultivation of stone fruits between Lakes Erie and Ontario provides ideal conditions for the development of the brown rot pathogen, *Sclerotinia fructicola* [34, p. 598]. Of recent years good control has been achieved by cultural practices, the use of better sprays and spraying equipment, and the reduction of insect damage which often provides an entry for the fungus. In 1955, however, severe losses of harvested fruit were sustained owing to a combination of adverse weather, a heavy crop, and glutted markets. Greater care in handling

picked fruit and strict sanitation with regard to infected material at all stages from the orchard to market is desirable.

In the Australian notes C. J. Magee describes the proposed scheme for the eradication of *Venturia inaequalis* [35, pp. 353, 422] and *V. pirina* from the isolated Yetholine district in the Central Tablelands of New South Wales. All apple and pear trees are to receive a pre-leaf fall spray of 0·1 per cent. phenyl mercuric chloride in 1956, the normal protective sprays during the season, and the eradicant treatment again in the autumn of 1957. Attempts to eliminate apple scab by cover cropping and the burial of fallen leaves were successful in Western Australia. New records include *Kabatiella caulivora* in New South Wales and *Urophlyctis trifolii* in Western Australia, both on subterranean clover.

From New Zealand H. C. Smith records an account by A. D. Thomson of methods for the identification of potato virus X. In serological laboratory tests 0·5 ml. each of antiserum and sap from diseased material collected in the field are mixed in small tubes and kept at 50° C. Approximately 100 of these tests can be performed by one technician in a single day. Fifty tests using the agglutination technique of Bradley [34, p. 55] may be performed in an hour by one man; the method is used in the field and laboratory. *Gomphrena globosa* is the most satisfactory indicator for the virus.

R. S. Vasudeva reports from India that the foorkey virus disease of the greater cardamom (*Amomum subulatum*) is destructive in the Darjeeling area of West Bengal. Diseased plants produce many stunted shoots, which fail to flower, and the leaves are slightly chlorotic. The disease is distinct from that affecting the lesser cardamom (*Elettaria cardamomum*), although both viruses are transmitted by the same vector, *Pentalonia nigronervosa* [35, p. 282]. The two viruses produce distinct symptoms on a wild *Amomum* sp. Plant diseases newly recorded from India include *Heterosporium tropaeoli* on *Tropaeolum majus*, *Alternaria ricini* on *Ricinus communis*, *Corynespora cassiicola* on tomato, and *Oidium caricae* on papaw [cf. 35, p. 308].

From Uganda B. J. T. Baldwin states that Panama disease of banana (*Fusarium oxysporum* f. *cubense*) [35, p. 277] was found in two new localities, Toro and Bugisu, and reconfirmed from Kampala. A banana fruit disease resembling cigar end rot yielded a *Fusarium* sp. Maize rust (*Puccinia polysora*) [loc. cit.] continued to be widespread but caused little damage. Resistance to *P. polysora* is now fully incorporated into 150 Muratha lines and is being introduced into K.8. Monthly spraying of *robusta* coffee with 0·3 per cent. perenox gave satisfactory control of *Hemileia vastatrix* and increased the yield two and a half times. The groundnut varieties Mwitunde and Kanyoma, reputed to be resistant, respectively, to rosette virus and leaf spots (*Cercospora* [*Mycosphaerella*] *arachidicola* and *C. personata* [*M. berkeleyii*]) in Tanganyika [cf. 35, p. 342], were susceptible to these diseases at Kawanda.

New plant diseases.—*Agric. Gaz. N.S.W.*, 67, 3, p. 139, 1956.

Among the new diseases reported in New South Wales for the six months ending 31st December, 1955 [cf. *R.A.M.*, 34, p. 706 and preceding abstract], were *Botrytis byssoidea* on onion [C.M.I. map No. 42]; *Sclerotium rolfsii*, causing collar rot of rough lemon; *Amphichaeta grevilleae* [cf. *R.A.M.*, 34, p. 179] on *Grevillea robusta* and *G. banksiae*; *Erysiphe graminis* on *Phalaris canariensis*; *Corticium salmonicolor* [30, p. 559] on *Prunus japonica*; broad bean wilt virus [27, p. 5] on vetch, lilac, *Digitalis purpurea*, *Anchusa italica*, and other hosts; *Sclerotinia* sp. and *Sphaerulina trifolii* [cf. 34, p. 358] on white clover (*Trifolium repens*) and *S. trifolii* on subterranean clover (*T. subterranea*); and the following on red clover (*T. pratense*): *Sclerotinia* sp., *Mycosphaerella carinthiaca*, *Sphaerulina trifolii*, *Stagonospora recedens*, and rugose leaf curl virus [34, p. 515].

Schwarz (Käthe), Dierberger (Renata), & Bitancourt (A. A.). **Estudos sôbre a câncer vegetal. I. A natureza química das auxinas de alguns tecidos vegetais normais e tumorais.** [Studies on crown gall. I. The chemical identity of the auxins of some normal and tumorous plant tissues.]—*Arq. Inst. biol., S. Paulo*, 22, pp. 93–118, 1 pl., 5 graphs, 1955. [English summary.]

At a special centre for the study of crown gall (*Agrobacterium tumefaciens*) in plants at the Biological Institute, São Paulo, Brazil, determinations were made of the Rf values of various synthetic indole compounds for comparison with naturally-occurring ones by means of ascending chromatography, using water as a solvent, and acetic acid or ammonia vapour or an isopropanol-water-ammonia mixture. The chromatograms were developed with Salkowski's reagent, sodium nitrite, or *p*-dimethylaminobenzoic aldehyde.

Indole-acetic acid or an auxin with the same Rf was detected by the *Avena* coleoptile test in the chromatographed ether extracts of *in vitro* cultures of crown gall tissue of tobacco, weeping willow (*Salix babylonica*), and sunflower, tumour tissue of *Nicotiana langsdorffii* × *N. glauca*, and normal tissue of *Parthenocissus tricuspidata*. The identity of the compound was further confirmed by the cherry-red stain with Salkowski's reagent directly on the chromatogram of the sunflower gall tissue. In the neutral fraction of normal *P. tricuspidata* and crown gall tissues of tobacco and *S. babylonica* the coleoptile test detected an auxin with the Rf of indole-acetic acid ethyl ester. Indole-acetonitrile or a related auxin was identified in tobacco and *N. langsdorffii* × *N. glauca* tissues infected by *Agrobacterium tumefaciens*. It gave a pale blue reaction to Salkowski's stain, and formed characteristic microcrystals with the tobacco sample in the presence of picric acid. Maize endosperm also contained these compounds.

The occurrence of several auxins with Rf values differing from those of the above-mentioned compounds was indicated by the coleoptile test. For instance, a very active auxin with an Rf of 0·05 was detected in the extracts of *Avena* coleoptiles and in the neutral fraction of *S. babylonica* tumour tissue.

Several chromatograms contained an inhibitor of coleoptile growth with an Rf of 0·95.

Kupila (S.). **Anatomical and cytological development of crown gall.**—*Arch. Soc. zool.-bot. fenn. Vanamo*, 10 (*1955*), 1, pp. 38–50, 9 figs., 1956.

Work at the Botanical Institute, University of Helsinki, Finland, showed that the morphology of tumours developing in tomato, pea, *Kleinia articulata*, *K. repens*, *Impatiens balsamina*, and a *Pelargonium hortorum* hybrid, inoculated with water suspensions of cultures of *Agrobacterium tumefaciens* from the University of Helsinki and strain 3 from the Royal Veterinary and Agricultural College, Copenhagen, varied with the species.

In the older galls necrosis at the centre, probably resulting from restricted metabolic exchange, was common. The first detectable change in the future gall cells is an increase in cytoplasm. Then they produce growth substances which induce changes in adjacent cells, and finally they either enlarge or divide to form small cells. Some factor inherent in the cell, not yet understood, seems to determine which of the courses an individual cell will take. Some of the small cells become tracheal. Diploid, tetraploid, and high polyploid cells were distinguishable. The diploid and tetraploid cells divided frequently, being responsible for most of the growth of the gall. In the large polyploid (up to 16-ploid) cells mitosis was not observed. The author considers it safe to conclude that endomitosis is induced by crown gall, though it is uncertain whether growth substances or some other factor are responsible.

Tollenaar (D.). **De toekomst der Cacao-cultur. Inzichten gegrond op ervaringen opgedaan in Latijns Amerika.** [The future of Cacao cultivation. Opinions based on observations made in Latin America.]—*Bergcultures*, 24, 4, pp. 79–81, 83–85, 87–89, 91–93, 95, 97, 3 figs., 1955. [English and Indonesian summaries.]

Included in this survey, supplemented by a review of 35 contributions to the literature, are summaries of the existing position in respect of the economic importance and control of the two most serious diseases of cacao in Latin America, brown rot (*Phytophthora palmivora*) [see next abstract] and witches' broom (*Marasmius perniciosus*).

Sanders (L. A.). **Bestrijding van bruinrot in Cacao (Phytophthora palmivora).** [Control of brown rot of Cacao (*Phytophthora palmivora*).] —*Bergcultures*, 25, 10, p. 264, 1956.

The following information was supplied by the author to the editorial committee of *Bergcultures* to supplement the article by D. Tollenaar on cacao cultivation [see preceding abstract]. In the British Cameroons, West Africa, the damage caused by *Phytophthora palmivora* [*R.A.M.*, 35, p. 278] is considerable, resulting in crop reductions of [up to] 90 to 95 per cent. on some farms in unfavourable seasons. On an estate of 520 ha. run by the Cameroons Development Corporation control operations are in progress with a mechanized mist-blower unit, consisting of a Ransome MG caterpillar tractor and a Kiekens-Dekker TT Model mist blower, the latter of Dutch origin. The performance of both machines is outstanding and two more units are to be operated. The cost of the tractor is about £400 and that of the mist blower £750. Perenox (containing 50 per cent. copper) is used at a dosage of 3 kg. in 170 l. water per ha. The entire tree is enveloped in the fungicide. On account of the very high incidence of infection and extreme humidity it is necessary at present to make ten successive circuits of the State, each occupying a period of three weeks, covering approximately 100 ha., and representing 80 hours of effective labour, with allowance for time lost through bad weather and so forth. The rate of travel is about 3 km. per hour. The estimated all-in cost of a single circuit (inclusive of depreciation) is £1. 17*s.* 6*d.*

Desrosiers (R.), Bolaños (C. W.), & Vargas (J.). **Evaluación de clones de Cacao en relación con su resistencia a la escoba de bruja (Marasmius perniciosus, Stahel).** [Evaluation of Cacao clones in relation to their resistance to witches' broom (*Marasmius perniciosus* Stahel).]—*Turrialba*, 5, 3, pp. 78–82, 1955. [English abstract. Received June, 1956.]

A quantitative method for evaluating the resistance of cacao clones to witches' broom (*Marasmius perniciosus*) based on that of Pound (1944, unpublished), was devised at the Tropical Experiment Station, Los Ríos province, Ecuador [*R.A.M.*, 35, pp. 4, 422], employing the 'broom-age ratio' which is calculated for each clone by dividing the mean number of brooms produced by all members of the clone of the same age by the age in years. In this way the clones under study are differentiated numerically and grouped according to the resistance shown. Before it can be considered resistant a clone must maintain a consistently low broom-age ratio for several years under conditions of severe infection.

Wellman (F. L.) & Orellana (R. G.). **Buba or cushion gall of Cacao in Nicaragua.** —*F.A.O. Pl. Prot. Bull.*, 3, 5, pp. 71–73, 2 figs., 1955.

An abnormal condition, 'buba' or cushion-gall disease, characterized by hypertrophy of the flower cushions, occurs along the fan-branches and on the trunks of old cacao trees in Nicaragua. It is also found on suckers, and occasionally on trees three to four years of age. Affected trees become unproductive. Occasionally, a

few normal flowers and full-sized pods may develop from the enlarged cushions. The dark brown, cauliflower-like, hemispherical galls are ⅛ in. to 3 in. in diameter. Several may arise from one cushion.

The condition was observed by A. G. Kevorkian in 1945 in the Rivas area of western Nicaragua (*Phytopathology*, 41, pp. 562–563, 1951). About 25 per cent. of the trees were affected, and in a few plantations the figure reached 75 per cent. The disease has since spread along the Escondido river as far north as Granada.

The cause is uncertain. Fresh galls of all sizes collected in the Rivas area were porous internally, each consisting of a whorl of buds which had branched and developed into a massive growth of hypertrophied flower pedicels and other abnormal tissues. The cells of the cushions were enlarged and thick-walled with intracellular strands of what appeared to be fungal mycelium. Isolations from the galls gave *Fusarium*, *Trichoderma*, bacteria, and a white, cottony, non-sporulating fungus, as yet unidentified. Mites were abundant in galls of all ages.

In the Rivas area, where cushion-gall is very severe, some cacao leaves were narrow and conspicuously mottled, as if by a virus disease, with sickle-leaf symptoms resembling those of zinc deficiency. Considerable die-back was also present on the affected trees. Volcanic ash from Mt. Concepcion is constantly falling in this district, and the leaves of the cacao trees are white with it. Further investigations are in progress.

South Australian Wheat crop championship competitions 1955–56.—*J. Dep. Agric. S. Aust.*, 59, 7, pp. 251–255, 267, 1956.

Stem rust [*Puccinia graminis*] was in evidence for the first time in eight years in South Australia [*R.A.M.*, 28, p. 622] in 1955–6. Loss of yield in susceptible varieties was between 10 and 20 per cent. Pinnacle and Bencubbin were particularly affected, yields being disappointing, though infection was light. Gabo back-crossed varieties showed good resistance. Covered smut [*Tilletia caries* and *T. foetida*: 35, p. 362] is almost completely under control following modern seed treatments [unspecified].

Hayden (E. B.). **Pathogenicity of races 11, 15B, 49, 125, and 139 of Puccinia graminis var. tritici to new spring Wheats, especially certain Kenya Wheats and their derivatives.**—*Phytopathology*, 46, 3, pp. 145–150, 1 map, 1956.

Some of the results of greenhouse experiments at the Minnesota Agricultural Experiment Station on the effect of temperature on the reactions of races 11, 49, 125, and 139 of *Puccinia graminis* on Kenya derivative wheat varieties have already been noticed [*R.A.M.*, 34, p. 286]. These four races are more pathogenic to Kenya 58 and Kenya 117A than race 15B [33, p. 715]. Kenya 338 A.A.1.A.2 and Kenya Farmer (Kenya 338 AC.2.E.2.) proved highly resistant to races 11, 49, 125, and 139, as well as to 15B, in all the tests at both high and low temperatures.

The reactions of Kenya 58 [34, p. 287], 117A, and Kentana to 15B were erratic, only a few large pustules developing on mature plants, mostly just above the nodes, in some experiments, while in others they were distributed over the whole plant. In some tests, moreover, temperature affected their response whereas in others it made no difference.

Varieties deriving resistance to *P. graminis* from Yaroslav emmer (*Triticum dicoccum*) or *T. durum* [34, p. 288] were generally resistant to races 11, 49, 125, and 139 in the greenhouse. Selkirk [35, p. 597] was resistant to most biotypes of 15B at temperatures below 70° to 72° but susceptible to the same isolates at higher ones. Selkirk seedlings inoculated with races 11, 49, 125, and 139 were fairly susceptible over a range of temperatures, the two latter causing the formation of large pustules on mature plants. At 70° to 75° and 80° to 85° full-grown plants of Sentry, a

durum wheat, were susceptible to 15B but resistant to 11, 49, 125, and 139. A degree of tolerance of 15B has also been observed in the bread wheats Rushmore (C.I. 12773) and Lee (C.I. 12488).

In 1954 the prevalence of races 49 and 139 declined sharply in the United States and Mexico, in contrast to the marked increase of those of the 17–29–37 and 48 complexes; the races of the former are distinguished from each other on the basis of the 'X' or mesothetic reaction on certain durum varieties of the standard differential assortment. This rapid shift in racial dominance re-emphasizes the need for continuous intensive trials to determine the reactions of breeding material to a composite of many races and biotypes of *P. graminis*.

In field tests from 1953 to 1955 Sentry showed some tolerance of rust and produced higher yields of higher test weight than other durum varieties exposed to 15B.

Hoffer (A.), Levine (M. N.), & Geddes (W. F.). **Effect of leaf and stem rust on the content and distribution of riboflavin in hard red spring Wheats at successive stages of kernel development.**—*Cereal Chem.*, 32, 5, pp. 347–355, 1955.

At the Minnesota Agricultural Experiment Station riboflavin [vitamin B_2] determinations were made on the grain, chaff, and straw from tillers harvested during kernel filling from plots of Thatcher and Marquis wheat inoculated in various ways with leaf and stem rusts [*Puccinia triticina* and *P. graminis*].

The average kernel weight was reduced by severe infection, particularly with *P. graminis*, which also accelerated transpiration to a greater extent than *P. triticina*, although the average seasonal load of the former was only 48·7 per cent. as compared with 89·5 per cent. of the latter. Beginning at the early or late milk stage, the concentration of riboflavin in each plant fraction decreased with every succeeding stage of kernel formation, irrespective of variety or rust intensities.

Owing to its adverse effect on yield, severe infection by *P. triticina* reduced the total riboflavin in the entire tiller by 23 per cent., as against only 9 per cent. for *P. graminis*; in the kernels, however, the corresponding figures were 34 and 38 per cent., respectively.

Increases in the total riboflavin content with progressive development of the kernels took place most rapidly in the least heavily infected plants of both varieties, the content of the mature kernels ranging from 12 to 22 per cent. of that of the entire tiller in the case of leaf rust and from 13 to 19 per cent. in plants infected by stem rust.

Johnston (C. O.), Hewlett (H. R.), & Borlaug (N. E.). **Physiologic races of Puccinia rubigo-vera f.sp. tritici in Mexico.**—*Phytopathology*, 46, 3, pp. 137–139, 1956.

Analyses made at the Kansas Agricultural Experiment Station from 1944 to 1953 (excluding 1945, 1946, and 1952) of the physiologic races of *Puccinia rubigo-vera* f.sp. *tritici* [*P. triticina*] represented in 153 collections of wheat from Mexico [*R.A.M.*, 31, pp. 10, 371] revealed a predominance of race group 11 in each year except 1949 and 1950. Taking the period of investigation as a whole, it comprised 51·2 per cent. of all isolates. Although race 11 has long been dominant on the Pacific Coast of the United States, it has not become significantly more abundant in the main wheat-producing area of that country during recent years [34, p. 287; 35, p. 431]. The prevalence of races 5, 15, 93, and 105 increased in Mexico from 1949 onwards.

Lindfors (T.). **Förekomst av Berberis i Sverige.** [Occurrence of *Berberis* in Sweden.] —*Nord. Jordbr-Forskn.*, 36, 1–4, pp. 241–244, 1954.

The devastating outbreak of black rust of cereals [*Puccinia graminis*] which occurred in Sweden in 1951 [*R.A.M.*, 35, p. 516] gave rise to a lively debate as to

its origin—whether from aecidia on indigenous barberries, overwintered uredospores, or wind-blown infective material from abroad. In this connexion figures are given of the many localities harbouring barberries (and in some cases of the actual numbers of bushes).

ZSCHEILE (F. P.). **The influence of temperature on the expression of bunt in susceptible and resistant Wheats.**—*Phytopathology*, 46, 3, pp. 168–174, 1956.

In further studies at the Department of Agronomy, University of Davis, California, seven days' growth under blue incandescent lights at 200 foot-candles after emergence and before transplanting to the field increased the average bunt (*Tilletia caries*) expression in nine susceptible wheat varieties [*R.A.M.*, 35, p. 289 and next abstract] by 146 per cent. over that of the field-sown controls. Three resistant varieties carrying the Martin gene and two resistant Turkey wheats also contracted infection.

When two series of resistant and susceptible variety pairs were grown to the boot stage under fluorescent lights at 1° to 22° and then moved to the greenhouse, a high incidence of infection developed in many susceptible varieties, while the resistant Baart and Poso were also attacked. Martin, a winter wheat, produced seed for the first time in greenhouse experiments. Under low-temperature conditions five varieties with the Martin gene and one each with the Turkey and XY factors for bunt resistance contracted the disease.

Five susceptible varieties were vernalized, before or after inoculation with chlamydospores, by 4½ weeks' storage at 0° following the inception of germination, and grown to maturity in the laboratory, greenhouse, or field. The effect of the treatment differed in the several varieties, depending on post-vernalization temperatures. Thus, in the laboratory it greatly reduced the percentage of infection while increasing it in the greenhouse in most of the varieties. The long period of vernalization and adverse soil conditions caused high mortality in the field, but the few surviving plants remained healthy.

In a comparison of two genetic populations in the laboratory and field the average incidence of bunt was much higher under the former conditions, suggesting the usefulness of an indoor environment for plant-breeding operations.

It appears from these studies that temperature control during the entire life-cycle of the host is essential for fundamental studies on the nature of bunt resistance, the expression of which is conditioned by temperature at various stages in the growth of the plant.

ZSCHEILE (F. P.). **Search for chlamydospores in Wheat seeds grown under conditions favourable to bunt expression.**—*Phytopathology*, 46, 3, pp. 182–183, 1956.

From the negative results of further microscope search for concealed chlamydospores of *Tilletia caries* within the kernels of externally normal wheat grain [*R.A.M.*, 35, p. 7 and cf. preceding and next abstracts], it is concluded that their presence is infrequent both in the susceptible Baart and the resistant Baart 38 variety under any of the conditions investigated to date.

ZSCHEILE (F. P.) & ANKEN (M.). **Limited development of Tilletia chlamydospores within Wheat kernels.**—*Phytopathology*, 46, 3, pp. 183–186, 8 figs., 1956.

In further studies on the development of bunt (*Tilletia caries* race 1) chlamydospores within externally healthy wheat kernels, ovules were examined in the young ovary from all the 26 wheat varieties used in investigations on the effect of low temperatures in the seedling phase on disease expression in the field [see preceding abstracts].

A 3-mm. kernel of Baart from the warm-room experiment contained a rather small number of chlamydospores surrounded by apparently healthy tissue.

Towards the stigmatic end the spore-filled area decreased to zero, whereas in the opposite direction it increased to about 90 per cent. of the cross-sectional area at the basal end. The spores at the centre of the sorus were the first to reach maturity, while those at the periphery were immature. A measure of resistance evidently existed in this plant of a normally susceptible variety, since not all the endosperm tissue was displaced by spores.

In a 5-mm. kernel of Baart 38, also from the warm room, a few chlamydospores developed in two adjacent centres, the contiguous sections of which coalesced. Some material staining deeply [with magdala red and light green] is usually present in such areas, where new spores are in process of formation. Many of the chlamydospores in other kernels produced by plants of this resistant variety grown at 12° C. were brown and marked by the reticulations characteristic of *T. caries*.

In young kernels, 2 mm. in length, of susceptible Big Club plants transferred to the field after germination and early growth at 10°, there were chlamydospores in many stages of development as well as fragments of dark-staining material which might have been mycelium. One out of three plants of the resistant Big Club 43 variety contracted bunt under the foregoing conditions. One transverse section contained only a few immature spores surrounded by kernel tissue, while many unripe and a few mature ones were present in another. Only 9 per cent. of the plants of the susceptible Federation, previously used as a control in a field test and inoculated by dusting dry chlamydospores on the seed immediately before sowing, developed infection. Here too the spores matured first near the centre of the sorus.

The difficulty of finding the examples illustrated in this contribution indicates their comparative rarity in experiments designed for the most part to promote bunt development. Nine of the varieties tested are normally susceptible, 11 resistant on account of the Martin gene, and five resistant because of other genes conferring this reaction to bunt.

Outbreaks and new records.—*F.A.O. Pl. Prot. Bull.*, 3, 5, pp. 76–78, 1955.

C. Sibilia states that some collections of wheat bunt from Milan, Parma, Campobasso, and Messina, Italy, examined in the herbarium of the Plant Pathology Station, Rome, were identical with *Tilletia brevifaciens* [*T. controversa*: *R.A.M.*, 35, p. 433].

Jensen (N. F.) & Tyler (L. J.). **The direct test for dwarf bunt in Wheat.**—*Agron. J.*, 48, 4, pp. 191–192, 1956.

At Cornell University Agricultural Experiment Station varieties and new lines of wheat were tested by a modification of a recently described method for reaction to dwarf bunt (*Tilletia brevifaciens*) [*T. controversa*: *R.A.M.*, 33, p. 145], in comparison with tests for common bunt, using *T. caries* race T-16 and *T. foetida*. Seed intended for sowing in the *T. controversa* and *T. caries* nurseries was treated with hot water before being inoculated. Inoculum of *T. foetida* was a composite of collections made in New York. Seed inoculated with T-16 and *T. foetida* was sown in separate nurseries on 23rd and 24th September, 1954, respectively. *T. controversa* inoculum was prepared by coarse-grinding infected wheat heads and mixing this thoroughly with top soil at 100 gm. per bush. on 9th August. On 6th October the seeds were sown in open rows, covered with infested soil at 4½ to 5 qt. per 5 ft. row, and then thinly with surrounding field soil. On 3rd December oat straw was laid on the dormant plants in a continuous cover at the rate of 1 bale per 200 sq. ft. and removed on 2nd April. Bunt was assessed from 20th to 25th June.

Of the wheat lines showing high resistance to all three species (1058 Fam., Sels. 3, 6, 8, and 9; 1041 Fam., Sel. 1; 4711 B–B–1; and Vogel-41, the last two being completely uninfected) 1058 Fam. Sels. 6, 8, and 9 and 1041 Fam. Sel. 1 developed bunt (0·4 to 3·8 per cent.) in the *T. controversa* nursery but not in that of T-16,

suggesting that reaction to the latter is not necessarily a reliable indication of reaction to dwarf bunt.

Ohms (R. E.) & Bever (W. M.). **Effect of time of inoculation of winter Wheat with Ustilago tritici on the percentage of embryos infected and on the abundance of hyphae.**—*Phytopathology*, 46, 3, pp. 157–158, 1 fig., 1956.

At the Illinois Agricultural Experiment Station individual heads of Wabash (C.I. 11384) winter wheat were inoculated daily with race 3 of *Ustilago tritici* [*R.A.M.*, 35, p. 290], beginning two days before anthesis and ending five days after. The highest percentage (97·9) of infected embryos was obtained by inoculation at anthesis, after which the proportion sank to 31·2 per cent. at the close of the test. After anthesis the percentage of smutted embryos containing large amounts of hyphae also decreased, while those with a small proportion increased.

Batts (C. C. V.). **Loose smut (Ustilago tritici (Pers) Rostr.) of Wheat ; physiologic specialization and reaction of varieties in England.**—*Ann. appl. Biol.*, 43, 4, pp. 533–537, 1955.

In studies carried out from 1950 to 1954 at the National Institute of Agricultural Botany, Cambridge, 57 wheat varieties were tested (most of them for at least two years) by the partial vacuum method of inoculation [*R.A.M.*, 34, p. 361] for their reaction to three races of loose smut (*Ustilago tritici*) [33, p. 204], C_1, C_2, and C_3, found in wheat varieties grown in Cambridge and identified on Oort's differential varieties [26, p. 445]. Races C_1 and C_2 were quite different from any of those identified by Oort, while C_3 was similar to Oort's race 2, but caused some infection in Florence × Aurore.

Infection of an ear could take place over a period of several days and there was a close relationship between the percentage of plants attacked and the severity of attack in a single plant. Twenty-one varieties were resistant to all three races. In contrast to Oort's results in Holland [loc. cit.], Bersee, Holdfast, and Staring were susceptible only to race C_2. In Holland, Chanteclair is susceptible only to race 7, but in the author's work it was susceptible to races C_1 and C_2. Jubilegem and Scandia are resistant in both countries.

Bruehl (G. W.). **Cephalosporium stripe disease of Wheat.**—*Phytopathology*, 46, 3, pp. 178–180, 1 fig., 1956.

During June and July, 1955, a disease of winter wheat apparently new to the United States was observed in both dry-land and relatively humid areas of five counties of Washington. Its symptoms agree with the stripe disease attributed by Nisikado *et al.* in Japan to *Cephalosporium gramineum* [*R.A.M.*, 18, p. 387], while isolates from both sources are also morphologically similar, the mean conidial dimensions on potato dextrose agar of the Washington and Japanese collections being 7·04 by 2·04 and 7·25 by 2·1 μ, respectively. Inoculation experiments with spore suspensions into the base of a Baart wheat and a White Winter barley plant resulted in the development of typical symptoms.

Nakagawa (M.). **Studies on ear-scab resistance of Wheat varieties. 2. Genetical factors affecting the inheritance of ear-scab resistance. 5. Alcohol fermentation by Fusarium fungus.**—*Jap. J. Breed.*, 5, 1, pp. 15–22; 2, pp. 107–109, 1955. [Japanese, with English summaries.]

In seven crosses between Japanese wheat varieties the inheritance of resistance to ear scab (*Gibberella zeae*) [*R.A.M.*, 35, p. 174] was shown to be governed by three factors segregating in the F_2 generation. Factor A is epistatic to B and C, B epistatic to C, A substatic to AB and AC, and AB and AC epistatic to BC. It is postulated that the following factors control scab inheritance in certain varieties:

Saitama No. 27 (Abc), Shinchunaga (ABc), Norin No. 26 (AbC), Norin No. 50 (aBC), and Norin No. 12 (abc). With a view to the development of completely resistant varieties (ABC), seed selection was undertaken in the F_2 with promising results.

A quantitative determination was made by means of potassium dichromate of the amount of alcohol produced in the glumes and kernels of seven wheat varieties, differing genetically in resistance to ear scab, after inoculation with *G. zeae*. Infected spikelets produced larger quantities of alcohol than the healthy, and the plant sap from the resistant varieties contained less than that of the susceptible when fermented by the addition of conidial suspensions.

CONNIN (R. V.). **The host range of the Wheat curl mite, vector of Wheat streak-mosaic.**—*J. econ. Ent.*, 49, 1, pp. 1–4, 1956.

The results of a study during the winter of 1953–4 at the Kansas Agricultural Experiment Station demonstrated the capacity of the wheat curl mite, *Aceria tulipae*, a vector of wheat streak mosaic virus [*R.A.M.*, 35, pp. 439, 600, and next abstract], to attack 27 varieties of wheat, six of barley, 16 of oats, 12 of sorghum, 10 of maize, and five of Sudan grass, as well as 12 out of 24 species of wild grasses [34, p. 588]. The mites transmitted the virus from wheat to the same host (all varieties), barley, oats, *Aegilops cylindrica*, *Bouteloua* (?) *hirsuta*, *Cenchrus pauciflora*, *Digitaria ischaemum*, *D. sanguinalis*, *Eragrostis cilianensis*, *Panicum capillare*, and *Setaria viridis*.

MILLER (P. R.). **Plant disease situation in the United States.**—*F.A.O. Pl. Prot. Bull.*, 3, 4, pp. 58–59, 1955.

Wheat streak mosaic virus [*R.A.M.*, 34, p. 631; 35, p. 175, and preceding abstract] was first recognized in Wyoming in July, 1951. In surveys made in 1952 infection (a trace to 100 per cent.) was observed in winter wheat in Laramie, Goshen, Platte, Niobrara, Sheridan, and Campbell counties. Infection was most severe and losses heaviest in localities with much volunteer wheat where the year before hail had threshed mature grain on to the ground. Some loss was caused to spring wheat planted near infected winter wheat. In June, 1953, the disease was further found in Johnson, Crook, Weston, and Carbon counties, the greatest losses being sustained in the south-east, where every one of the 145 fields inspected concontained mosaic. In the autumn of 1953 approximately 90 per cent. of the 60 fields of young winter wheat inspected in Laramie, Goshen, and Platte counties were affected. Infection was most severe in volunteer and early-sown wheat.

The warm late autumn of 1953 and the open winter were conducive to a build-up in the population of the vector, *Aceria tulipae*. Severe infection of winter wheat occurred in June, 1954, crop losses being greatest in the east. In the north-east infection ranged from a trace to 25 per cent. A few fields in Crook County had 100 per cent. infection, with total loss in some. Infection of spring wheat was high in fields planted late and situated near diseased winter wheat. A trace of infection was found in a few fields of barley and oats. *Setaria viridis*, *Bromus tectorum*, *B. japonicus*, and *Echinochloa crus-galli* [35, p. 439] became infected under natural conditions. The disease was found only occasionally in spring grains in irrigated farming areas.

In 1953 Frontier barley in a nursery at Laramie was affected by false stripe virus [35, p. 442]. In 1954 incidence was rather high in Frontier, Compana, Spartan, and Glacier barley and Pilot wheat in nurseries at Laramie, Torrington, Sheridan, and Gillete. Almost every barley field in the north-east carried infection ranging from a trace to 5 per cent., with 25 per cent. in one. In north central districts only a trace of infection was found in a few scattered fields.

In 1954 cereal yellow dwarf virus [see next abstract] was found wherever small

grains are grown in Wyoming. At least a trace of infection was present in almost every field of barley and oats inspected. Infection appeared to be heaviest in the irrigated sections of Goshen County. In barley the highest incidence was about 10 per cent. The virus was transmitted to Victory oats by *Macrosiphum granarium* and *Toxoptera graminum* from diseased plants of Cheyenne wheat collected in fields heavily infected by wheat streak mosaic virus.

Suneson (C. A.). **Breeding for resistance to yellow dwarf virus in Barley.**—*Agron. J.*, 47, 6, p. 283, 1955.

The dominance of susceptibility to cereal yellow dwarf virus in crosses between the resistant Rojo and susceptible California Mariout barley [*R.A.M.*, 33, p. 74 and preceding abstract] was established in California during 1952 and 1953. In 1954 a back-cross population, the equivalent of 895 F_2 plants derived from 12 parental lines equalling Rojo in resistance, was divided into the following well-defined classes: 641 susceptible, 209 resistant, and 45 without infection, indicating a single recessive gene difference between Rojo and California Mariout. Since after four back-crosses the gene is now set in plants predominantly resembling California Mariout, it appears to be destined for early use to reduce yield losses from yellow dwarf in the extensive areas to which this variety is adapted.

Poehlman (J. M.) & Cloninger (C. K.). **Resistance to three Barley smut diseases in Missouri Early Beardless strains.**—*Agron. J.*, 47, 6, pp. 243–246, 1955.

In inoculation studies at the Missouri Agricultural Experiment Station, some results of which have already been noticed [*R.A.M.*, 34, p. 591], all of the Missouri Early Beardless barley selections and hybrid strains of the same parentage tested were susceptible to the highly virulent collection 35 of *Ustilago nuda*, with the possible exception of B 405. All the selections except B 495 and all the hybrid strains except Mo. 5–400 were resistant to races 1 to 4 of *U. nigra* [29, p. 359; 30, p. 407]. The hybrid strain B 637 (a cross with Michigan Winter) was resistant to all 13 races of *U. hordei* [29, p. 359]; B 355 to races 1 to 4 and 8 to 11; hybrid B 696 (with Kentucky 2) to races 1, 2, 4, 5, 6, 10, and 13; and several other selections and hybrid strains to races 1, 2, 3, 5, 6, 8, 11, and 13.

Baker (E. P.) & Upadhyaya (Y. M.). **Physiologic specialization in crown rust of Oats.**—*Proc. Linn. Soc. N.S.W.*, 80 (*1955*), 3, pp. 240–257, 1956.

Physiologic race specialization within field collections of *Puccinia coronata* [f.] *avenae* on oats made during 1952–4 [*R.A.M.*, 32, p. 617] was investigated at the University of Sydney, using the differential varieties Anthony, Victoria, Appler, and Bond from the old set and Bondvic and Saia in addition. Tests were also made on Santa Fe, Trispernia, Ukraine, and Landhafer. Eight races were recorded on the new and ten on the former set. Race 259, which was first detected in the field on the variety Vicland, also infects Victoria and other varieties. Races attacking another source of resistance, Bond, do not appear to be increasing. Trispernia, Landhafer, Santa Fe, and Ukraine, specifically introduced for rust resistance, were attacked by a new race designated 286, which is found only in Australia. It is concluded that the new set of differentials should be used for Australian determinations with the addition of the variety Klein and some others for the differentiation of local biotypes.

Changes in pathogenicity in Australia can only be accounted for by mutation in the absence of the alternate host plant (*Rhamnus*) and by experimental proof that heterokaryosis produces this type of variability. Suggestions for breeding resistant varieties include incorporating genes by interspecific hybridization, experimental production of host plant mutations for resistance within economic varieties, and the use of combined resistances to increase the usefulness of newly released varieties.

KONZAK (C. F.). **A note on the use of radiation for the production of mutations for Victoria-blight resistance in Oats.**—*Phytopathology*, 46, 3, pp. 177–178, 1 fig., 1956.

Recent observations at Brookhaven National Laboratory, Upton, Long Island, New York, having suggested that the close linkage in oats of resistance to crown rust (*Puccinia coronata*) and susceptibility to Victoria blight (*Helminthosporium sativum*) [*H. victoriae*] was due to a complex genetic locus rather than to pleiotrophic effects of the same gene [*R.A.M.*, 28, p. 390], an irradiation project was initiated to study the genetics of the associated susceptibility to *H. victoriae* and resistance to *P. coronata* in oats [33, pp. 149, 665].

Blight-resistant mutants were selected from the progeny of irradiated seeds of susceptible varieties by means of a seedling inoculation technique [35, p. 363], and tests were then made to determine their reactions to races 57, 203, and 211 of *P. coronata*. Such mutants were readily developed in the Tama, Park, and Victoria varieties by irradiation with X-rays, fast neutrons, and thermal neutrons. The data from preliminary tests indicate that they are mostly susceptible to crown rust, though a few have shown either the 1-, 2-, or 3-type reaction (in a scale from 0 = resistant to 4 = susceptible). Most of the mutants have produced a fair amount of seed, but those with the type-1 rust reaction were almost completely sterile.

The results of these experiments, though far from conclusive, are considered to offer some support for the complex-locus hypothesis. To secure more definite evidence, however, it will be necessary to select and test with *P. coronata* a far larger number of blight-resistant mutants than have hitherto been available.

TVEIT (M.) & WOOD (R. K. S.). **The control of Fusarium blight in Oat seedlings with antagonistic species of Chaetomium.**—*Ann. appl. Biol.*, 43, 4, pp. 538–552, 1955.

In researches [a preliminary account of which has already been noticed: *R.A.M.*, 32, p. 552] at the Botany Department, Imperial College, London, on the possibility of controlling infection of oats by *Fusarium* spp., chiefly *F. nivale* [*Calonectria nivalis*: loc. cit.], with antagonistic fungi, 47 isolates of *Chaetomium* representing 27 species were used. Containers were two-thirds filled with a mixture of washed sand and gravel, and 2·5 gm. of a wheat-vermiculite-glucose culture of each *Chaetomium* isolate spread over the surface. Thirty heavily infested oat seeds from Norway were placed in each and covered with an inch of sand. In the controls autoclaved cultures were used; as additional treatment no culture material was added, but the seed was treated with a mercury dust. The seeds were incubated at 15° C. The same experiment was also carried out with an unsterile medium loam. In both tests *C. cochlioides* isolate A gave 75 to 100 per cent. healthy seedlings, or approximately as good control as the mercurial dust. Strains B and C of *C. cochlioides* and strain A of *C. globosum* gave 50 to 74 per cent. healthy seedlings. In the controls emergence was poor and almost all the plants were dead or badly diseased at the 2 to 3-leaf stage.

In a test of different methods of applying the antagonist living perithecia of *C. cochlioides* A, applied to the surface of infected seed by shaking it with a sieved, air-dried culture mixed with sodium carboxymethylcellulose as an adhesive, resulted in 84 per cent. emergence with 81 per cent. healthy plants at the 2 to 3-leaf stage. When infected seed was soaked for 24 hours in a culture filtrate of the same strain emergence was 85 per cent. and there were 84 per cent. healthy plants.

When infected seed was sown in receptacles containing unsterile soil to which cultures of *C. cochlioides* A had been added ten months before, emergence was 86 per cent. and at the 3 to 4-leaf stage there were 84 per cent. healthy plants. Experi-

mental evidence also showed that *C. cochlioides* A and *C. globosum* A were able to compete successfully with soil flora and become established in unsterile soil in the presence of suitable substrates. The results of the pot experiments were confirmed in the field.

Evidence was obtained that [unspecified] bacteria appear to play some part in the development of lesions usually attributed solely to attack by seed-borne *Fusarium* spp. Bacteria were always present in large numbers in lesions on the mesocotyl and roots and disease symptoms were seldom produced when sterile oat seedlings were grown in tubes in the presence of actively growing cultures of *Fusarium* spp. from oat seed. If, in fact, bacteria are an important factor in the development of disease under natural conditions, then the antibacterial activity of the antibiotics secreted by isolates of *Chaetomium* [35, p. 601] may also be of importance in preventing disease.

HOOKER (A. L.). **Correlation of resistance to eight Pythium species in seedling Corn.**—*Phytopathology*, 46, 3, pp. 175–176, 1956.

At the Iowa Agricultural Experiment Station the relative resistance of 45 monoploid-derived diploid maize lines and three synthetic varieties to pure-culture inoculations with *Pythium aphanidermatum*, *P. arrhenomanes*, *P. debaryanum* [*R.A.M.*, 35, p. 445], *P. graminicola* [35, p. 364], *P. irregulare*, *P. paroecandrum*, *P. rostratum*, and *P. splendens* [34, p. 521] was measured in quartz sand over steamed soil at 10° C.

The majority of the lines were relatively susceptible to most of the *P.* spp., among which the least pathogenic were *P. rostratum* and *P. arrhenomanes*. Nine of the strains were markedly resistant and nine highly susceptible. The 28 possible correlation coefficients, calculated to determine whether the reactions of the maize strains when inoculated with one species of *Pythium* were correlated with their responses to infection by another, were all significant at the 1 per cent. level. Thus, the resistance to *Pythium* in seedling maize appears to be not highly specific but operates against several species.

COX (R. S.). **Control of the Helminthosporium blight diseases on Sweet Corn in Florida.**—*Phytopathology*, 46, 2, pp. 112–115, 2 graphs, 1956.

In 1954 and 1955 at the Everglades Experiment Station, Florida, maneb at 1½ lb. in 100 gals. gave excellent control of *Helminthosporium turcicum* [*R.A.M.*, 35, p. 444] and *H. maydis* [*Cochliobolus heterostrophus*: loc. cit.] on Golden Security sweet corn in tests to compare a number of fungicides with the standard nabam (2 qts.) plus zinc sulphate (¾ lb.), and zineb (2 lb.), of which the former was superior to all others both in reduction of infection and increase of yields, especially fancy-grade. Also effective were ziram, vancide Z-65, and C & C Exp. No. 7443, all at 2 lb. The treatments, numbering 15 in the autumn and 12 in the spring trials, were applied with a spray equipment already described [34, p. 736]. The moderate incidence of infection developing in the spring apparently left a sufficient area of healthy leaf to support normal formation of the first (but not of the second) ear even in the absence of fungicidal treatment, and it is postulated that the cultivation of one- instead of two-eared varietes might considerably simplify the control programme or even obviate the need for it altogether.

1954 Illinois Corn tests.—*Bull. Ill. agric. Exp. Sta.* 585, 31 pp., 1 map, 1955.

In trials at Urbana, Illinois [cf. *R.A.M.*, 34, p. 363], conducted by J. W. PENDLETON, B. KOEHLER, A. L. LANG, P. E. JOHNSON, and J. H. BIGGER, 70 inbred maize strains grown in regular test fields were classified for resistance to Stewart's disease

[*Xanthomonas stewarti*: 35, p. 292] according to the number of lesions per leaf, irrespective of general die-back. The strains varied greatly in their resistance; 18 had been studied in the previous year and there was good correlation between the results for the two years. Six lines were rated at 0 (in general showing merely a trace of disease in six replications). There was also correlation between resistance to *Helminthosporium turcicum* [35, p. 291] (observed in 1951), and resistance to Stewart's disease in the same strains (observed in 1953). This observation is confirmed by field reports of resistance to Stewart's disease in strains bred for resistance to *H. turcicum*.

Smut [*Ustilago maydis*] was estimated to have caused a 2 per cent. reduction in maize yield in the State as a whole. There were striking and consistent differences between the levels of infection in different strains [34, p. 607]. Five lines received the O rating. *Gibberella zeae*, one of the causes of stalk rot [34, p. 364], was especially prevalent in the northern part of the State, causing much stalk breakage in some fields. Stalk rot caused by *Diplodia zeae* [35, p. 292] was about twice as common, affecting about 34 per cent. of the stalks, but did not cause much lodging.

Following unusually strong attacks of maize earworm (*Heliothis armigera*), the incidence of ear rot (*Fusarium moniliforme*) [*Gibberella fujikuroi*: 34, p. 364] was the highest for ten years, a survey showing 43 per cent. of the ears to be infected, for the most part only at the tips.

Chauhan (S. K.). **Preliminary investigations on the disease intensity and crop loss in the smut of Bajra Pennisetum typhoides Stapf and Hubb. caused by Tolyposporium penicillariae Bref.**—*Agra Univ. J. Res.* (*Sci.*), 4, 2, pp. 367–372, 1 graph, 1955. [Received June, 1956.]

In studies at the Botany Department, Agra College, the author sought for a correlation between crop loss, estimated by Chester's method [*R.A.M.*, 29, p. 521], and the intensity of infection (percentage infection of grains) in smut disease (*Tolyposporium penicillariae*) of pearl millet (*Pennisetum typhoides*), observed in three districts offering different micro-climatic conditions (determined by a thermohygrograph within the crop 9 ins. from the ground) at the time of infection [32, p. 543].

Only in one district, Bareilly, with low temperature (68° to 95° F.) and high relative humidity (55 to 92 per cent., with 90 per cent. for about 12 hours) at the time of infection, was there a significant correlation (at the 5 per cent. level). Here, it was calculated, the loss in yield increased by an average of 84 lb. per acre for a 10 per cent. increase in disease intensity.

Of the other districts Mainpuri had higher temperatures with similar humidity, while Agra had higher temperatures with lower humidity. Further trials are to be carried out in these two areas.

Ramakrishnan (T. S.) & Sundaram (N. V.). **Further studies on Puccinia penniseti Zimm.**—*Proc. Indian Acad. Sci.*, Sect. B., 43, 3, pp. 190–196, 1 pl., 1956.

In further studies at Coimbatore on the life cycle of *Puccinia penniseti* [*R.A.M.*, 29, p. 148] the authors noted that where crops of eggplant and pearl millet (*Pennisetum typhoides*) grew close together both were heavily attacked by the rust. In inoculation experiments healthy pot plants of *Solanum melongena* var. *insanum*, *S. pubescens*, *S. torum*, and *S. xanthocarpum* were all infected by teleutospores and produced pycnia and aecidia. Two types of uredosorus were noted, one isolated and scattered and the other grouped on dark brown lesions. These were shown to represent two races of the fungus.

Out of 32 cultures of millet one variety showed promising resistance, but this is of little practical value as the crop is cross fertilized in the field.

x x

Cooper (W. C.) & Peynado (A.). **Correction of iron chlorosis of young Grapefruit trees on Cleopatra Mandarin rootstock with chelated iron.**—*Proc. R. Grande Vall. hort. Inst. 1954.* pp. 106–109. 1 fig., 1954.

In experiments at the Texas Agricultural Experiment Sub-station, Weslaco, Texas, chlorosis of small Ruby red grapefruit trees on Cleopatra mandarin stocks was corrected, sometimes within eight weeks, by a single soil application of 27 gm. of iron chelated with EDTA [*R.A.M.*, 35, p. 124] per tree, 4 gm. with hydroxyethylethylenediamine triacetic acid (EDTA-OH), or 13 gm. with diethylenetriamine pentaacetic acid (DTPA) [*id.*, 35, p. 293 and next abstract]. Foliage applications were less successful.

Cooper (W. C.) & Peynado (A.). **Experimental control of iron chlorosis of Citrus in some Rio Grande Valley soils with chelated iron and with gypsum.**—*Proc. R. Grande Vall. hort. Inst. 1955.* pp. 79–85. 1 fig., 1955.

Iron chlorosis of grapefruit [see preceding abstract], both on calcareous soil and on land irrigated with water containing residual sodium carbonate, was corrected by soil applications of EDTA-OH. The condition is mainly limited in calcareous soil to small trees, which often recover unaided. Gypsum was of no use as a corrective on calcareous soils, but was very effective on non-calcareous soils containing residual sodium carbonate. EDTA and EDTA-OH were both liable to cause chelated-iron injury [*R.A.M.*, 35, p. 40], but not DTPA.

Bitancourt (A. A.). **Estudos sôbre a leprose dos Citrus. I. Distribuição geografica e sintomatologia. II. Transmissão natural as folhas. III. Transmissão natural as frutas. IV. Experiências de tratamento.** [Studies on Citrus leprosis. I. Geographical distribution and symptomatology. II. Natural transmission to the leaves. III. Natural transmission to the fruits. IV. Experiments on treatment.]—*Arq. Inst. biol., S. Paulo*, 22 pp. 181–231. 11 pl., 1955. [English summaries.]

Information already presented on leprosis virus of citrus in São Paulo, Brazil [*R.A.M.*, 22, p. 500; 23, p. 385; cf. 32, p. 421], and elsewhere is recapitulated and supplemented by further data collected since the time of the earlier studies. Sweet orange is the principal host, but sweet and West Indian limes, sour orange, lemon, citron, grapefruit, tangerine, and mandarin are occasionally affected. The virosis has also been observed in São Paulo on the foliage of *Myrciaria glomerata-costata* [*Arq. Inst. biol., S. Paulo*, 6, pp. 205–211, 1935] and on the leaves and fruits of *Annona muricata*, while Vergani has recorded it from Argentina on the leaves and shoots of *Lippia turbinata* [*Rev. argent. Agron.*, 9, pp. 282–294, 1942].

In the first of four experiments performed between 1938 and 1942 young potted trees of the Lisa Pauliata, Sanguinea, Campista, Pelé de Moça, Sabará, red and white selections, Barão, and Hamlin sweet orange varieties and Florida mandarin were placed under adult trees with heavily sported leaves so that the foliage was in close contact for varying periods. A disease index was calculated for each tree, these being assigned to classes numbered 0 (no spots), 1 (1 to 10%), 2 (20 to 50%), and 3 (over 50%). The class number was multiplied by a factor of 1, 1·125, 1·25, 1·5, and 2·5 according to the number of months (12, 4, 3, 2, or 1) under the diseased tree. No spots developed on the mandarin and the mean disease index for the Sabará sweet orange (believed to be a hybrid of sweet orange and tangerine) was only 0·01, possibly due to three experimental trees being wrongly assigned to this variety. The indices of the red and white selections were 1·62 and 1·65, respectively, while those of the other varieties ranged from 1·12 to 1·33. The mean class numbers of all varieties remaining for 1, 2, 3, 4, or 12 months under the infected tree were 0·36, 0·9, 1·11, 1·12, and 1·32, respectively, showing the progressive rise in the incidence of sporting with length of exposure. The lesions on the different

varieties were of the type commonly observed in São Paulo, except for Lisa Paulista, on which they were large, irregular, and chlorotic, without necrosis of the central tissues.

The second experiment was carried out with 147 Pera sweet orange trees, 150 of Bahia (navel), and 192 of Sabará, groups of 11 to 16 being placed each month over a year under the same diseased tree as before for two-monthly periods, beginning in February. The disease classes 1 to 3 were revised to cover 1 to 9 spots, 10 to 30, and more than 30, respectively. Sabará remained free from infection and the mean class numbers for Pera and Bahia were 0·57 and 0·53, respectively. Trees in contact with diseased foliage from January to June developed more spots than the others. On Pera the lesions were rather smaller and the centres more necrotic than those on Bahia, which were concentrically zonate.

Different trees were used as sources of infection in the third trial, namely, a mandarin and the sweet orange of previous tests at Cantareira, four Bahia oranges at Campinas, and several sweet oranges of a commercial orchard at Taubaté. Under them were placed 84 Sabará trees and 53 each of Pera and Bahia during the period from March to September. Sabará again remained completely healthy, while the mean class number for the other two varieties (computed as in the second test) was 1·24.

In the fourth experiment 80 potted sweet orange seedlings, which were lightly pruned on 12th or 27th February or 13th or 28th March to induce sprouting, were placed on 23rd April in these groups under the four diseased Bahia trees previously used at Campinas. On 9th May half the trees were removed and sprayed with lime-sulphur to destroy the acarid vector of leprosis, *Tenuipalpus pseudocuneatus* [*R.A.M.*, 24, p. 446], the rest being left *in situ* until the 23rd. The mean class number of the trees (calculated as before) exposed to infection for a month was more than double that of those with only a fortnight's contact. The mean class numbers of trees sprouting for 4, 6, 8, and 10 weeks were 0·9, 1·25, 1·3, and 1·15, respectively, indicating that the younger leaves of the first group were less susceptible than older ones.

In experiments covering the period from 1939 to 1942 young sweet orange fruits on the tree were enclosed in jars stoppered with cotton wool to exclude the vector. When the fruits were ripe they were classed as before for number of spots. In 1939 the tests extended from the last week in January to 5th June, when only three out of 22 protected fruits developed a few spots, the disease index being 0·14 compared with 0·77 for the same number collected at random elsewhere on the tree, which developed up to 21 spots, while fruits on the ground near the infected tree were much more heavily spotted.

In 1940 the jars were again placed in position at the end of January and control fruits enclosed in wire baskets to prevent them from dropping at maturity. For protected fruits ripe on 21st and 29th May the disease indices were calculated as 1·26, and those ripe on 25th June, 0·31, indicating the greater resistance of younger fruit to leprosis; the index for the controls was 2·58.

Throughout the next two fruiting seasons the jars were removed for periods of about a month. At maturity the disease indices for January, 1940–1 and 1941–2, were 0·05 and nil, respectively; for February 0·97 and 0·2; for March 1·16 and 1·16; for April 0·44 and 0·63; and for May 0·22 and 0·4; the corresponding figures for the unprotected fruits being 2·8 and 2·32, respectively. Maximum infection coincided with mid-development of the fruit. In parallel tests in 1940 and 1941 fruits of the same sweet orange seedling and (in 1940) of a Pera tree were enclosed in wire-screen boxes of 8-, 14-, 20-, 28-, and 40-mesh, resulting in disease indices of 0·9, 0·83, 0·54, 0·66, and 0·4, respectively, compared with 2·72 in the controls. It is apparent that the screens afforded a measure of protection (roughly proportional to the size of the mesh) by impeding the vector.

Between 1933 and 1944 sweet orange trees of different varieties at Cantareira and Campinas were either drastically pruned [21. p. 74] or sprayed with fungicides and insecticides, or treated in both ways. While pruning completely suppressed the formation of spots on the fruits of the succeeding crop it also reduced production to a minimum. On trees pruned in the previous year the percentage of infected fruits was 3·6 per cent. compared with 37·6 in the untreated controls. In seven experiments covering the same number of years, the percentages of infected fruits on trees sprayed with Bordeaux mixture or fungol (copper oxychloride) ranged from 6·7 to 34·2 – exceeding those on the untreated trees in two instances. On trees sprayed with lime-sulphur [31. p. 326] the minimum incidence of infection was 1·3 and the maximum 12·7 per cent., the corresponding figures for oil emulsion sprays, such as citrol and laranjol, being 1 and 15·3, respectively, and for the controls 10·8 and 37·6, respectively.

MARTIN (J. P.), KLOTZ (L. J.), DEWOLFE (T. A.), & ERVIN (J. O.). **Influence of some common soil fungi on growth of Citrus seedlings.** *Soil Sci.*, 81. 4, pp. 259–267. 1 fig., 1956.

At the University of California Citrus Experiment Station, Riverside, a greenhouse study was made of the influence of common soil fungi, separately and in various combinations, on the growth of sweet orange seedlings in Yolo sandy and Holtville clay loam. Fumigation of the soil with propylene oxide and inoculation with spore suspensions generally resulted in the establishment of the species selected for testing, which were isolated by the dilution plate technique, using a peptone dextrose-rose bengal-streptomycin medium [*R.A.M.*, 29. p. 433], adjusted to pH 7. Once a foothold was gained, a particular species tended to resist the establishment of others for extended periods.

Most of the organisms used in the experiments exerted little or no effect on host development, but *Thielaviopsis basicola* caused drastic reduction of growth [30. p. 366], which was lessened to some extent by combination with *Penicillium expansum* or *Stachybotrys atra*, but not with *P. chrysogenum*, *P. funicolosum*, *Trichoderma viride* [34. p. 781], or *Fusarium solani*. *Pythium ultimum* did not significantly impair the health of the seedlings, and the influence of *Phytophthora citrophthora* and *P. parasitica* [loc. cit.] was negligible.

NEWHALL (W. F.) & GRIERSON (W.). **A low-cost, self-polishing, fungicidal water wax for Citrus fruit.**—*Proc. Amer. Soc. hort. Sci.*, 66. pp. 146–154, 1 fig., 1 graph, 1955.

A stable wax emulsion, referred to as 101 A, imparts a high gloss to citrus fruits, retards shrinkage, is self-polishing and fungicidal, and is composed of inexpensive synthetic waxes and resins. Application is made by dipping the fruit or by flooding the emulsion over it. The preparation contains dowicide A and hexamine [*R.A.M.*, 35. p. 511]. At the Florida Citrus Experiment Station, Lake Alfred, Valencia oranges picked in April and May, 1954, treated, and stored at 70° F. showed 78, 76, and 42 per cent. reduction in [unspecified] decay after one, two, and three weeks, respectively. The emulsion is also satisfactory on grapefruit and particularly suitable for the more tender citrus varieties such as Temple oranges and tangerines.

MINZ (G.). **Uncooled summer-storage of Citrus fruits.**—*Ktavim* (*Rec. agric. Res. Sta.* [*Rehovot*] *Israel*), 4, 2, pp. 15–16, 1956.

From work at the Agricultural Research Station, Rehovot, Israel, the author concluded that mature Valencia oranges and grapefruit picked in mid-April and early picked lemons from clean groves can be kept in uncooled storage for 12 to 16 weeks if wrapped in paper impregnated with diphenyl [*R.A.M.*, 33. p. 347].

Shamouti oranges picked not later than the end of March could be stored for up to 12 weeks in the same way.

Graniti (A.). **Note fitopatologiche. II Casi di gommosi del fusto di Agrumi da 'Botrytis cinerea' Pers. nella Valle del Temo (Sardegna).** [Phytopathological notes. II Cases of stem gummosis of Citrus caused by *Botrytis cinerea* Pers. in the Temo Valley (Sardinia).]—Reprinted from *Agricoltura ital.*, 55 (n.s. 10), 5 pp., 1955. [English summary. Received 1956.]

Several cases of stem-rotting and gummosis were observed on orange trees in the Temo Valley near Bosa (Nuoro), Sardinia, during the winter of 1951, apparently associated with wounds caused by flooding the previous autumn. Inoculation experiments with the pathogen, *Botrytis cinerea* [*R.A.M.*, 34, p. 782], were positive on three orange varieties, mandarin orange, and lemon.

King (H. E.) & Lawes (D. A.). **Studies of bacterial blight.**—*Progr. Rep. Exp. Stas Cott. Gr. Corp. (Northern Nigeria), 1954–5*, pp. 12–14, 1956.

In experiments on the control of bacterial blight of cotton [*Xanthomonas malvacearum*: *R.A.M.*, 34, p. 645; 35, pp. 357, 524] in northern Nigeria seed treatment with sulphuric acid and agrosan GN 5, used separately, exercised a marked effect on early growth and health, and when both were applied to the same seed the improvement was even greater. At the end of the season the percentage stands for raw (i.e. ordinary saw-ginned) seed undressed and dressed with agrosan were 80 and 84, respectively, machine-delinted, similarly treated, 76 and 87, and acid-treated 89 and 90. The corresponding percentages for blight incidence 79 days after sowing were 84 and 47, 85 and 46, and 59 and 50. Agrosan was more effective against the disease than sulphuric acid.

The outstanding differences between the three treatments shown by counts of stands from undressed and dressed seed 30 days after sowing (49 and 0, 35 and 0, and 6 and 0) were subsequently reduced as the disease spread. The plots from the agrosan-treated seed that became infected late showed no advantage in yield over those from untreated seed, at least in the early pickings.

Weiser (J.). **Die Krankheiten des Tannentriebwicklers, Cacoecia murinana Hb. in der Mittelslowakei (ČSR). (Vorläufige Mitteilung.)** [The diseases of the Fir Tortrix, *Cacoecia murinana* Hb., in central Slovakia (Czechoslovakia). (Preliminary note.)]—*Z. PflKrankh.*, 63, 4, pp. 193–197, 3 figs., 1956. [English summary.]

Three out of 481 larvae of *Cacoecia murinana* on fir [*Abies*] in the Hron Valley, Czechoslovakia, examined at the Biological Institute, Academy of Sciences, Prague, during the summer of 1955 were found to be infected by *Beauveria* spp.—two by *B. globulifera* and one by *B. bassiana*.

Whiteside (J. O.). **Stem-break of Sunn Hemp in Southern Rhodesia.**—*Rhod. agric. J.*, 52, 5, pp. 417–425, 4 pl., 1 diag., 1955.

The first authentic record of stem break (*Colletotrichum curvatum*) of *Crotalaria juncea* in Southern Rhodesia [*R.A.M.*, 35, p. 92] occurred in 1947, but the disease was probably present long before this. Infection usually develops first near the leaf axils, causing a leaf wilt. In young tissues the fungus advances rapidly, seedlings and young plants soon being destroyed; older plants withstand infection longer. Stem lesions are light brownish-green, later dark brown or black. By the time the crop begins to set seed the stem is usually woody enough to resist breakage, but infection may continue to develop in the younger, apical tissues. The inflorescence may also be attacked, particularly the flower stalks and pods. Early infection

results in loss in bulk of the material available for ploughing in: when it is delayed these effects are less serious, but the yield and quality of the seed are impaired.

No other hosts have been found locally. *C. intermedia*, an indigenous species, remained completely immune from infection by every isolate tested. All locally available strains of sunn hemp appeared to be equally susceptible.

The results of the author's investigations confirmed that seed transmission takes place, though the fungus seldom penetrated the seed coat. In a field trial the most rapid and severe development of stem break occurred in plots sown with seed from a healthy crop with diseased trash added. No disease was observed when the mixture of clean seed and diseased trash was treated with various fungicides before sowing, or in plots sown with surface-sterilized seed from diseased pods. Only one of three plots receiving untreated seed from a diseased crop developed infection. It would seem that internal seed-borne infection is probably less important than infection from diseased trash. Preliminary results showed that *C. curvatum* can survive on trash throughout at least one dry season even when buried to a depth of ½ in. Where sunn hemp is regularly used in rotation it should be alternated with other green manures.

Since spore dispersal depends on water, factors which contribute to the surface run-off, such as slope of land, inadequate cover of vegetation, and breakdown of soil tilth, also assist in spreading the disease. A dense stand favours infection and the development of weak stems. Early planting can reduce the severity of an outbreak by enabling a crop to pass through the susceptible early stages of growth before the arrival of heavy rains. Unfortunately, this practice cannot be generally applied, as early crops are frequently attacked by insects. Experimental evidence indicated that the disease is likely to cause more damage to crops in which growth has become retarded because of nutritional deficiencies than to those grown in fertile soil. Seed treatment with thiram at 3 oz. per 200 lb. is recommended.

Silberschmidt (K.) & Tommasi (L. R.). **Observações e estudos sôbre espécies de plantas suscetíveis à clorose infecciosa das Malváceas.** [Observations and studies on species of plants susceptible to infectious chlorosis of the Malvaceae.]—*Ann. Acad. bras. Sci.*, 27, 2, pp. 195–214, 4 pl., 1955. [English summary.]

Following a survey of the literature on the host range of infectious chlorosis of Malvaceae [Abutilon variegation virus: *R.A.M.*, 35, p. 184], the authors present important new information on this aspect of the disease (or disease-complex). The virus is here reported for the first time to have been found occurring naturally on *Sida rhombifolia* in Panama, Nicaragua, and San Salvador; on *S.* sp. and *Malvastrum* sp. on the coast of Venezuela; and on *S. acuta* var. *carpinifolia* in Santa Cruz de la Sierra, Bolivia. In the herbarium of the Biological Institute, São Paulo, Brazil, there are further specimens on *M. spicatum*, *Malachra alceifolia*, *M. rudis*, *Melochia pyramidata*, *S. rhombifolia*, *S. urens*, and *Anoda cristata* from different regions of Colombia. A table is given showing the Brazilian hosts of the virus, including, besides those already recorded, a number of other *S.* spp., *Wissadula* sp., *Abutilon crispum*, *Malvastrum coromandelianum*, *Pavonia subhastata*, *P.* sp. near *mattogrossensis*, *Malva nicaensis*, hollyhock, *Triumfetta semitriloba*, *T.* (?) *rhombifolia*, *Luehea grandiflora*, *Phenax sonneratii*, and *Waltheria americana*.

It would appear from the data that, at any rate in the Americas, latitude 30° north and south of the equator forms the boundary of the area of natural dissemination of the Abutilon variegation virus. On the other hand, symptoms resembling those of the virosis were observed on *Lavatera* sp. and *M. sylvestris* in Argentina: *Anoda lavateroides* in the Botanical Garden, Amsterdam, Holland; and *L. trimestris*, *M. nicaensis*, *M. borealis*, and other *M.* spp. in the Royal Botanic Gardens, Kew, i.e., outside the supposed limits of its spontaneous occurrence and of the only known vector, *Bemisia tabaci*. The virus was transmitted experimentally by the

white fly from diseased *S. rhombifolia* plants to *M. borealis*, *M. crispa*, *M. nicaensis*, *M. sylvestris*, *M. verticillata*, *M. duriaei*, *Modiola multifida*, *Althaea cannabina*, hollyhock, *A. taurinensis*, *Anoda hastata*, and *L. alba*. It was also possible, though difficult, to infect *S. acuta* var. *carpinifolia* in the same way.

Dame [F.]. **Pflanzenschutzmittel im Blumen- und Zierpflanzenbau.** [Plant protectives in flower and ornamental culture.]—*Gesunde Pfl.*, 7, pp. 189–197, 1955. [Abs. in *Z. PflKrankh.*, 63, 4, p. 256, 1956.]

Injury to seed from mercurials may be avoided by the use of low concentrations (0·05 to 0·1 per cent.) for a 30 minute steep (0·1 per cent. for two hours for bulbs and tubers). For the treatment of cuttings mercurials or quinosol (both at 0·05 to 0·1 per cent.) are largely used in Germany, the former especially on carnations, while captan, ziram, and zineb (the last-named particularly for hydrangeas) are becoming increasingly popular and together with ferbam are the principal fungicides for older plants. They are readily tolerated, whereas wettable sulphurs and highly concentrated coppers are more limited.

Andreucci (E.). **Il marciume pedale del Garofano da 'Sclerotium rolfsii' Sacc.** [Basal rot of Carnation caused by *Sclerotium rolfsii* Sacc.]—*Riv. Ortoflorofruttic. ital.*, 39, 7–8, pp. 344–348, 6 figs., 1955.

In the summer of 1952 most of the plants in a commercial planting of carnations near Valdinievole, Tuscany, Italy, covering hundreds of sq. m. were destroyed by a basal rot due to *Sclerotium rolfsii* [cf. *R.A.M.*, 27, p. 47; 33, p. 707], hitherto not recorded on this host in Italy. Rapid and complete withering of the affected plants occurred. In 1953 and 1954 infection was only sporadic and caused no serious loss.

In 1952 exceptional weather conditions prevailed; almost unbroken drought persisted from 5th May until the end of July, the maximum daily temperatures frequently being above 35° C. and reaching 39° during the first ten days of July. From 27th to 29th July 86 mm. of rain fell, followed by a further period of drought until the night of 20th August when 144 mm. of rain fell. During the next few days maximum temperatures reached 30° and infection increased to epidemic proportions.

Growers are warned not to take soil or plants from infected to uninfected areas. Where the disease is found for the first time all affected plants should be destroyed and the soil round them disinfected. In plantings where the disease has already appeared growers may experiment with nitrogenous dressings [cf. 21, p. 399]; but soil disinfection is more reliable.

Cash (Edith K.) & Watson (Alice J.). **Some fungi on Orchidaceae.**—*Mycologia*, 47, 5, pp. 729–747, 5 figs., 1955.

Full technical descriptions are given of a number of fungi collected from living orchid plants by inspectors of the Plant Quarantine Branch, Agricultural Research Service, United States Department of Agriculture, at ports of entry. The species involved include *Mycosphaerella cattleyae* n.sp., *Physalospora* spp., *Valsella pedicellata* n.sp., *Phyllostictina pyriformis* n.sp., *Phomopsis orchidophila* n.sp., *Septoria selenophomoides* n.sp., and *Gloeosporium* and *Colletotrichum* spp. No estimate of the pathogenic importance of these fungi could be made.

Smith (J. D.). **Turf disease notes 1955.**—*J. Sports Turf Res. Inst.*, 9, 31, pp. 60–75, 3 pl., 1 graph, 1955. [Received June, 1956.]

The author briefly summarizes the incidence of the major turf diseases occurring in Great Britain during 1955 and describes the control of fairy rings caused by

Marasmius oreades, *Lycoperdon* spp. [*R.A.M.*, 33, p. 428], and *Psalliota campestris* by modifications of Cunningham's method (*Agric. Rep. Govt. Res. Comm., N.Z. Golf Ass.*, pp. 44–46, 1934). For *M. oreades* the affected turf and a 12 in. healthy margin is removed, the soil below watered with 6 pints 40 per cent. formaldehyde plus ½ pt. of agral LN. lysapol, to repel as a wetter, in 10 gals. water to 10 sq. yds., and the whole area covered with pegged sacks for seven to ten days. The removed soil is then stored with a fork and left for two weeks to allow the vapour to escape, after which it is returned or remixed. The treatment should be applied before any production. For *Lycoperdon* spp. and *P. campestris* half the amount of formaldehyde is used. The affected turf is forked over, treated, and covered, after which it is removed, the soil beneath forked up and exposed for two weeks and then returned or remixed. Experiments on the control of pre-emergence damping-off, caused mainly by *Fusarium culmorum* [27, p. 141], indicated that mild mercurial seed-dressing should not be practised, but thiram may be used under semi-experimental conditions when damping-off is expected, particularly with the slower germinating fine turf grasses.

Corticium bicolor, which has not been recorded in the British Isles, was found on specimen turf of *Cynodon dactylon* from Tenerife, Canary Islands, Spain.

Helminthosporium vagans [33, p. 5–6] was found on moist plots of *Poa pratensis* at the Experiment Grounds. *H. nodulosum* [36, p. 173] was present on dry and withered leaves of *Agrostis stolonifera* on a golf green in Cornwall.

Smith, J. D. **Fungi and turf diseases.**—*J. Sports Turf Res. Inst.*, 9, 31, pp. 35–59, 1 pl., 1 diag., 1955. [Received June, 1956.]

Part V of this series of papers is devoted to dollar spot disease (*Sclerotinia homoeocarpa*) [*R.A.M.*, 34, p. 529], which is common on sea-marsh fescue turf (mostly *Festuca rubra* ssp. *rubra*) used on lawns and bowling greens in Great Britain. It has been observed in its natural habitat on the Lancashire and Cumberland coast. Typical symptoms were produced on New Zealand Chewing's fescue (*F. rubra* ssp. *commutata*), New Zealand browntop (*Agrostis tenuis*), *A. stolonifera*, *Holcus lanatus*, *Poa annua*, and *P. pratensis* inoculated with a culture from *F. rubra* ssp. *rubra* of sea-marsh origin. There are several distinct strains of the fungus, all differing in their capacity to sporulate in culture. British strains grew slowly in culture at 0° to 1° C., the optimum being 20° to 25°. No marked differences in the rate of mycelial growth were observed within the range pH 4 to 7. Once it is well-established the disease is very persistent. In winter infected spots may fade out but they reappear in the spring together with new ones. During dry summers the spots increase slowly in diameter to their maximum, new spots often developing in the autumn. The disease is most severe on sea-marsh turf when plant vigour is low. An adequate supply of nitrogen aids in recovery and may increase resistance. Infection appears to be spread on infected leaf fragments. Seasonal outbreaks in spring and autumn coincide with the time of spore production in culture.

During 1954–5 a series of control experiments were continued on naturally infected sea-marsh fescue and on artificially infected turf. The results of the preliminary trials have already been noticed [*loc. cit.*]. One fungicidal application markedly reduced the amount of disease in an established infection and protected against further attacks. The best material from this aspect was ammonium WB Mo containing molybdate growth, but efficient control lasting until the following spring was obtained only with three fungicide applications at about ten-day intervals. Plots receiving no nitrogen and no fungicide had up to 75 per cent. diseased turf but generally threw over-ling ½ lb. and 2 oz. ammonium sulphate per sq. yd. following the third ammonium application showed no disease. Kernimate (a calomel compound), was the most efficient of the American materials in reducing disease incidence by a single application. Of the British materials used at double

rate (40 gm. dry) the best long-term control was obtained with zineb (33 p. 429). Grasofulvin prevented dollar spot on two strains of red fescue.

FENN (M. G.). **Control of Fusarium patch disease in France.**—*Pl. Path.* 5 : 4 pp. 497–498. 1956.

Following preliminary trials in 1954 at the Sports Turf Research Institute, Yorkshire, by [J.] D. Smith, in which it was found that two treatments at a ten-day interval of solusamegran [based on methoxyethyl mercury chloride] at 50 gm. in 12 l. water for 120 sq. m. turf gave very good control of *Fusarium* [*F. nivale*: *R.A.M.*, 33, p. 429] and *Fusarium* patch disease [*Rhizoctonia praticola*: 34 p. 520] without any injury to the turf, the product was tried out on golf greens at two courses in France in September 1955. At Evian attacks of patch on untreated greens occurred regularly in October and spread very rapidly to cover the whole green; at Lyons they were frequent but less severe. Apart from one green on each place which had a slight attack, eliminated by a further treatment, treated greens were completely free from patch in 1956. The cost of treating an average green of 400 sq. yds. once was approximately 5s. 4d., exclusive of wages. Solusamegran is not yet available on the British market.

DUNLEAVY (J. I.). **Kernel smut of Big Bluestem.**—*Phytopathology*, 46 : 2 pp. 114–120, 3 figs., 1956.

Kernel smut (*Sphacelotheca cordensis*) of *Andropogon provincialis* has been reported only from the United States and Canada [*R.A.M.*, 9 p. 744; 33 p. 430]. It causes severe stunting, reducing the height of the panicles from between 4 and 7 ft. to a minimum of under 1 in. and a maximum of 3 ft. The linear sori developing from the ovaries turn from silver-grey to dark brown at maturity. They measure 6 to 10 mm. in length and are covered by a hyaline membrane that detaches from the apex, revealing a powdery mass of reddish-brown, ovoid to spherical chlamydospores. The smut overwinters in the rhizomes of infected plants which become sterile and die in a few years. A low percentage of infection was obtained by inoculation of the rhizomes with chlamydospore and sporidial suspensions.

A histological examination of plants taken as soils from local pastures or grown from seed harvested in north-central Nebraska disclosed the presence of hyphae throughout the parenchyma cells of the rhizomes, stems, and flowers, but not in the meristematic zones. With the development of chlamydospores the portal tissue elongated rapidly and was replaced externally by a hyphal mat, beneath which a layer of chlamydospores was produced as sorus formation proceeded. A central column of portal tissue remained intact in the mature sorus.

S. cordensis grew well on sterilized soil rich in manure and on potato and maize meal dextrose, Fowler's, and Richards's agar media. The optimum temperatures for growth of monosporidial lines ranged from 25° to 33° C. and for chlamydospore germination from 20° to 28°. A pH of 6 promoted best growth. Chlamydospores from three separate localities in the State each germinated best on a different medium, and monosporidial isolates from the several sources varied in cultural characters.

GRYLLS (N. E.). **An outbreak of rugose leaf curl on Clover in Queensland.**—*J. Aust. Inst. agric. Sci.*, 22 : 3 pp. 187–188. 1956.

A disease causing high mortality in red clover (*Trifolium pratense*) at Warwick, Queensland, was ascertained to be due to rugose leaf curl virus [*R.A.M.*, 34 p. 513]. The vector, *Austroagallia sexmila*, is widely distributed in all the mainland States of Australia except Victoria, and is probably present there too. This is the first record of a major field outbreak of the disease in Queensland.

HANSON (A. A.) & GRAHAM (J. H.). **A comparison of greenhouse and field inoculation of Ladino Clover with Sclerotinia trifoliorum.**—*Agron. J.*, 47, 6, pp. 280–281, 1955.

A selected group of 75 single cross Ladino clover plants evaluated in the greenhouse for resistance to *Sclerotinia trifoliorum* [*R.A.M.*, 32, p. 436] were set out in the field at the United States Regional Pasture Research Laboratory, Pennsylvania, to determine whether the level of resistance established in the greenhouse would be of economic significance under field conditions and to compare the greenhouse and field responses. The greenhouse ratings for the progenies included in the field experiment were 24 resistant × resistant progenies, 24·3 per cent. healthy survivors, 22 resistant × susceptible, 15·3 per cent.; and 29 susceptible × susceptible, 11 per cent.

The effectiveness of artificial inoculation (broadcast application of dried grain inoculum in December) was adequately demonstrated by an average spring survival of 21·6 per cent. compared with 95·6 per cent. for the uninoculated. The field survival of some single cross progenies following inoculation was sufficiently better than that of commercial Ladino clover to be of economic significance. Although the greenhouse inoculations were effective in isolating some superior plants the field results demonstrated the difficulty in relying on them exclusively. The excellent field survival of some resistant × susceptible and susceptible × susceptible progenies suggested that errors occurred in the greenhouse classification of clones, the accumulation of virus disease and the interaction between winter injury and *S. trifoliorum* probably contributing to the low predictive value of these tests. It would appear therefore, that greenhouse tests should be confined to checking the response of plants isolated from field inoculation trials.

DARLING (S.) & HANSON (L.). **Symptom reaction of individual Red Clover plants to yellow Bean mosaic virus.**—*Phytopathology*, 46, 3, pp. 150–152, 1 fig., 1956.

Yellow bean mosaic is the virus most frequently isolated in Kentucky from old clover plants with variable foliar symptoms, such as a mild or severe green or yellow mottle with yellowing, distortion, vein necrosis, or lethal systemic necrosis [*R.A.M.*, 17, p. 61; 28, p. 288]. In these experiments it was recovered from 113 out of 126 naturally infected plants, identification being based on host range, symptoms, mechanical and aphid transmission, and intranuclear inclusions in broad bean [21, p. 41]. Of 1,851 mechanically inoculated seedlings of the Kenland variety 503 showed vein-yellowing or tuberous mottle of varying intensity and 57 necrosis, mostly mild; 12 eventually became plants died. Of 126 inoculated vegetatively propagated clones, eight remained symptom-free, 95 were more or less severely stunted, 10 were both chlorotic and necrotic, and 13 developed systemic necrosis. All plants within a clone develop similar symptoms, which may, however, differ conspicuously in individual clones.

SINGH (S. S.). **Effect of shallow and deep sowing on the incidence of root-rot and wilt of Cyamopsis psoraloides DC.**—*Agra Univ. J. Res. (Sci.)*, 4, 2, pp. 373–377, 1955. [Received June, 1956.]

In further work at the Government Agricultural College, Kanpur, in 1951 and 1952 the author [*R.A.M.*, 31, p. 366; 34, p. 156, and next abstract] sowed guar (*Cyamopsis psoraloides*) by hand rake, harrow, cultivator, ordinary plough, and Meston plough at depths approximating to 2·5, 5, 7·6, 10·5, and 14 cm., respectively, in soils inoculated with *Rhizoctonia* [*Corticium*] *solani* causing root rot, or with *Fusarium oxysporum* [wilt]. With *C. solani* emergence under the first two treatments (93 and 93 per cent.) was significantly higher than under the remaining three (77, 75, and 66 per cent., respectively). For *F. oxysporum* the emergence

percentages under the five treatments were 90, 100, 95, 91, and 85, respectively, mortality with plough sowing being significantly higher than with the other treatments.

SINGH (R. S.) & SINGH (B.). **Root rot and wilt of Cyamopsis psoraloides in relation to thick and thin sowing of the crop.**—*Agric. Res. J. Kaira* (*Sci.*), 4, 2, pp. 379–385. 1955. [Received June, 1956.]

In further work at Kaira [see preceding abstract] from 1949 to 1952 a low seed rate of 4 to 6 seers (approximately 8 to 12 lb.) per acre was found to reduce mortality in guar (*Cyamopsis psoraloides* from *Rhizoctonia* [*Corticium*] *solani* and *Fusarium vasinfectum*, and also to increase the yield of fodder and grain. Planting with a space of 24 to 26 in. between plants had a similar effect.

BROOKS (R. M.) & OLMO (H. P.). **Register of new fruit and nut varieties. List 20.**—*Proc. Amer. Soc. hort. Sci.*, 66, pp. 447–454. 1955.

This further list of new fruit and nut varieties developed in the United States and Canada (*cf. R.A.M.*, 35, p. 39) includes the Dr. John G. Du Puis avocado of unknown parentage, resistant to scab [*Sphaceloma perseae*: 20, p. 450; 32, p. 694] the Stark Late Gold peach, from Hal-Berta Grant × an Elberta seedling, resistant to brown rot [*Sclerotinia fructicola*: 34, p. 568], the Starking Delicious pear of unknown parentage, resistant to fireblight [*Erwinia amylovora*: loc. cit.] and the Steelemaster strawberry, from Fairland × Marshall, said highly resistant to all races of red stele [red core: *Phytophthora fragariae*: 33, p. 470; 34, p. 347] known in the eastern United States, and resistant to scorch [*Diplocarpon earliana*: 33, p. 490], though rather susceptible to leaf spot [*Mycosphaerella fragariae*: loc. cit.; 35, p. 420].

THEIN (H.). **Betrachtungen zur Symptomatologie der obstbaulichen Abbaukrankheiten.** [Observations on the symptomatology of degeneration diseases in the orchard.]—*Pflanzenarzt*, 8, 2, pp. 13–22, 17 figs. 1956.

Full descriptions are given of the symptoms and distribution of cherry and other fruit viruses in nurseries and orchards of the Heidelberg district and elsewhere in Western Germany [*cf. R.A.M.*, 33, p. 142; 35, p. 372, and next abstract].

KOTTE (W.). **Ernährungs- und Viruskrankheiten der Obstgehölze und ihre Bedeutung für die Praxis.** [Nutritional and virus diseases of fruit genera and their importance in practice.]—*Obstwein Ptf.*, 7, pp. 1–8. 1955. [Abs. in *Z. PflKrankh.*, 63, 4, p. 220. 1956.]

The symptoms of the principal nutritional disorders of fruits (potash, magnesium, iron, and boron deficiencies) in Germany [*R.A.M.*, 35, p. 47], are described and control measures indicated, with special reference to interrelationships between nutrients and differential soil fixation by nutrient salts. Of primary importance among viroses [see preceding abstract] are those affecting raspberries and strawberries [35, p. 378] and the Pfeffinger disease of cherries [35, p. 374], but more attention should also be paid to apple mosaic [35, p. 372] and pear stony pit. The symptoms of these diseases are described and figured to illustrate confusion with nutritional disturbances.

BLUMER (S.). **Über die Flachastigkeit (Rillenkrankheit) bei Apfelbäumen.** [On flat limb (groove disease) of Apple trees.]—*Schweiz. Z. Obst- u. Weinb.*, 65, 7, pp. 148–153, 5 figs., 1956.

The symptoms of flat limb virus on apple trees are described and experiments on its transmission reported from Wädenswil, Switzerland [*R.A.M.*, 34, p. 250 and

next abstract]. The anatomical features of the spindle-shaped thickenings of the wood originally described by R. Bovey [branch swellings; 34, p. 599] show a large measure of agreement with those of flat limb and may be another expression of the same virosis. Spindle wood is associated with poor growth, sparse foliation, and insufficient lignification.

Schlums (W.) & Baumann (G.). **Die 'Flachästigkeit' des Apfels in Mitteldeutschland.** ['Flat limb' of the Apple in central Germany.]—*NachrBl. dtsch. PflSchDienst, Berl.*, N.F., 10, 3, p. 56, 1 fig., 1956.

The authors report the occurrence of the flat limb virus [see preceding abstract] on a 20-year-old Gravenstein apple tree near Leipzig, as well as on a Golden Pearmain and an unknown variety in the environs of Torgau, central Germany [cf. *R.A.M.*, 34, p. 80], with brief notes on its symptoms and geographical distribution.

Kearns (H. G. H.), Marsh (R. W.), & Morgan (N. G.). **Spray application problems: XIX. Further field experiments on the control of Apple scab by small volume sprays.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 134–137, 2 diags., [1955].

Further studies in this series [*R.A.M.*, 34, p. 600] concerning the application of lime-sulphur and captan for the control of apple scab [*Venturia inaequalis*: see following abstracts] on Cox and Worcester showed that large-volume, run-off spraying with either material virtually eliminated the disease in a season favourable for scab, but that lime-sulphur caused extensive russeting on Cox. Five small-volume, air-flow applications at 50 gals. per acre, with 1 or 2 per cent. lime-sulphur or 0·1 per cent. captan, were unsatisfactory, but an additional application of either in the latter part of June or an increase in concentration to 4 per cent. lime-sulphur or 0·4 per cent. captan gave a high degree of control.

Byrde (R. J. W.), Clarke (G. M.), & Harper (C. W.). **Spraying experiments against Apple scab at Long Ashton, 1954.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 147–152, 1 diag., [1955].

In a large-scale trial at Long Ashton Research Station, Bristol, in 1954 on the control of apple scab (*Venturia inaequalis*) [*R.A.M.*, 34, p. 601 and preceding and following abstracts] 0·075 per cent. captan was substituted for 0·75 per cent. lime-sulphur in the post-blossom spray applications on Cox's Orange Pippin. There was a significant reduction in fruit russet and an improvement in fruit size, but a significantly higher (four to ten times) incidence of apple mildew (*Podosphaera leucotricha*) [35, p. 614]. Both treatments gave excellent control of scab, which was less than 0·08 per cent.

Marsh (R. W.). **A summary of Apple scab control experiments at Long Ashton, 1944–54.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 153–161, [1955].

Most of the information on experiments on the fungicidal control of apple scab [*Venturia inaequalis*: see preceding abstracts] at Long Ashton Research Station, Bristol, from 1944 to 1954 has been noticed from time to time in this *Review*. A bibliography of 16 titles is appended.

Crossall (H. E.). **The problem of Apple scab spraying.**—*N.A.A.S. quart. Bull.*, 29 (*1955*), pp. 216–219, 1955.

This paper, based mainly on references (17 titles), deals briefly with the problems of spraying apples against scab [*Venturia inaequalis*: *R.A.M.*, 34, p. 770 and preceding abstracts] in England. The most efficient fungicides and methods of application are discussed. Most of the information has already been noticed in this *Review*.

CORKE (A. T. K.). **Bitter rot of Apples. I. Branch inoculations with Gloeosporium perennans and G. album.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 164–168. 1 graph, [1955].

From June, 1953, to June, 1954, branches of Cox's Orange Pippin apple trees at Long Ashton Research Station, Bristol, were inoculated with mycelium and spore suspensions of *Gloeosporium* [*Neofabraea*] *perennans* [*R.A.M.*, 35, p. 508] and *G. album* [34, p. 157] to throw light on their seasonal behaviour in the orchard, because of their part in the recent increasing losses of stored apples. The time of appearance of cankers and their subsequent growth were recorded. Inoculations with mycelium of *N. perennans* were successful throughout the year, but those with spore suspensions induced cankers to any extent only in November and December, indicating that summer pruning is not necessarily associated with a high level of infection. Plant resistance (as measured by the low rate of canker growth) and rate of callus formation are highest during August and September, and danger from infected pruning cuts apparently greater in November and December than January and February. Inoculations with *G. album* were effective only from July to September when a small proportion produced short-lived, non-sporing cankers. The life-cycle of this fungus requires further investigation.

BYRDE (R. J. W.) & CORKE (A. T. K.). **The role of eradicant fungicides in the control of Apple canker : III. A supplementary note.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 162–163, [1955.]

Further laboratory studies at Long Ashton Research Station, Bristol, on the sporulation of *Nectria galligena* [*R.A.M.*, 34, p. 601] on apple cankers treated with 0·3 per cent. phenyl mercury chloride in the autumn showed that normal sporulation (ascospores) was re-established 18 months after the last treatment.

SMITH (H. C.). **Collar-rot and crown-rot of Apple trees.**—*Orchard. N.Z.*, 28, 10, pp. 16–17, 19, 21, 1955.

In New Zealand collar rot (*Phytophthora cactorum*, infection of the trunk above ground) [*R.A.M.*, 34, p. 213; 35, pp. 103, 283] caused the death of Cox's Orange [Pippin] trees, the most susceptible variety, 15 years of age or more, within six months of inoculation, but five- and two-year-old trees survived, though actively infected. Of other varieties tested, Sturmer was the most susceptible, Rome beauty, Kidd's orange, Ballarat, and Dougherty were moderately susceptible, while Delicious and Granny Smith were resistant. The standard rootstock, Northern Spy, proved moderately resistant to crown rot (infection of the roots and lower trunk), and Antonovka and Merton 779 and 793 appeared to be more so. Merton 789, East Malling XIII and XV, and Robusta stocks were all markedly susceptible.

Previous indications that the fungus exists in several forms were confirmed [33, p. 359]; isolates from Cox were the most infective, those from pear fruit and gooseberry root less so, and from Jonathan apple root the least. Soil infection, traced by burying apples and subsequently identifying the fungus in them, was found to be correlated with the extent of the disease and is apparently an important source of its origin. These observations also indicate the danger of leaving fallen fruit on the ground.

To control the disease susceptible varieties, such as Cox's Orange and Gravenstein, should be budded not less than 22 in. above ground level on resistant stocks. Periodic inspection should be made and infected areas excised, with subsequent wound treatment. Maintenance of good drainage is important.

Skin blemish on 'Alfriston' Apples.—*Tasm. J. Agric.*, 26, 3, p. 262, 1 fig., 1955.

An unusual blemish developed on Alfriston and Democrat apples in Tasmania during the 1954–5 season, consisting of slightly sunken, translucent spots, $\frac{1}{8}$ to $\frac{1}{4}$ in.

in diameter, or confluent over large areas of skin. The blemish was confined to the surface, and was worst on the shaded side of trees and fruit. It could not be attributed to any spray, and was possibly due to the high temperatures that prevailed. It resembled in some ways watercore [cf. *R.A.M.*, 18, p. 687] which was common on other varieties during the same season.

Gilmer (R. M.). **Probable coidentity of Shiro line pattern virus and Apple mosaic virus.**—*Phytopathology*, 46, 2, pp. 127–128, 1 fig., 1956.

At the New York (Geneva) Agricultural Experiment Station symptoms indistinguishable from those of apple mosaic virus developed in three out of six apple seedlings inoculated in 1950 with isolate A 10/1–4 (recurrent necrotic ring spot and sour cherry yellows viruses), which was also shown by K. G. Parker (unpublished data) in 1952 to contain the Shiro plum line-pattern virus [cf. *R.A.M.*, 34, p. 732]. In July, 1953, apple seedlings and Shiro plum budlings were bud-inoculated with isolate A 10/1–4 from plum, while another series of tests was performed on the same hosts with material obtained directly from apple infected with a strain of apple mosaic. In February, 1954, the trees were forced in the greenhouse, half in each series being grown at 75° F. and the rest at alternating temperatures of 75° (day) and 55° (night).

The two isolates induced symptoms of apple mosaic in the apple seedlings and of line-pattern in the plum budlings at both the constant and alternating temperatures: the development of chlorotic or creamy-white areas on the leaves was more pronounced, however, under the latter conditions. As the season advanced and temperatures rose, the symptoms in newly formed leaves of both apple and plum became increasingly masked, and above 90° the foliage showed no sign of infection.

In reinoculation experiments the line-pattern virus from apple produced its characteristic symptoms on plum, while conversely, the apple mosaic isolate from plum caused typical mosaic symptoms on apple.

The results of these and Kirkpatrick's experiments [loc. cit.] are considered to afford strong presumptive evidence of the identity of the line-pattern virus of *Prunus* spp. and apple mosaic virus.

Millikan (D. F.) & Guengerich (H. W.). **Transmission to Amelanchier of an agent causing a disorder on Apple.**—*Phytopathology*, 46, 2, p. 130, 1 fig., 1956.

An abnormality of the Virginia Crab apple variety, widely used in Missouri as an interstock, notably for Golden Delicious, usually appears first as a willowy growth in the scaffold branches. Vertical, superficial lesions increasing to fissures up to 10 by 1 in. next develop on the Virginia Crab stem piece, the xylem of which is invariably pitted [cf. *R.A.M.*, 34, p. 602]. These symptoms are regarded as suggestive of an infectious entity to which Virginia Crab is particularly susceptible.

On 7th April, 1954, buds from a diseased Golden Delicious on Virginia Crab were inserted into an *Amelanchier* bush, on which they grew to a length of 3 to 4 in. On 10th May, 1955, the *Amelanchier* shoot above the inserted apple bud developed conspicuous mottled patterns, accompanied by dwarfing and rugosity of the leaves. The localization of the abnormal features indicated very slow spread of the presumed virus.

Helton (A. W.) & Moisey (J. A.). **Cytospora damage in Idaho Prune orchards.**—*Plant Dis. Reptr*, 39, 12, pp. 931–943, 13 figs., 1955.

A *Cytospora* sp. causing canker on Italian Prune plums was observed for the first time in Idaho in 1951 in the Parma area near Homedale. Similar cankers were also found on sweet cherry. In recent orchard surveys the fungus was observed on cherries, peaches, apricots, apples [*R.A.M.*, 33, p. 84], and willows [*Salix*], indicating that it is serious and widespread in most of the south-western part of the State.

Five isolates from prune were severely pathogenic on peach and apricot, attacked Mahaleb cherry and sometimes pear, but failed to infect apple and Mazzard cherry.

On prune the disease is characterized by yellow-brown flags, small, pale leaves which appear late in the spring, and the failure of terminal parts to set buds, having probably died during the winter. The type of canker depends on the variety infected. The fungus is believed to gain entrance through pruning wounds or through winter injury. The latter can be reduced by the standard procedures. All parts suspected to be diseased should be cut out carefully during the usual pruning season and all the prunings burnt.

Ward (J. R.). **Diseases of Peaches and Nectarines.**—*Tasm. J. Agric.*, 26, 1, pp. 52–58, 4 figs., 1955.

The author gives a short account of peach leaf curl (*Taphrina deformans*), [*R.A.M.*, 34, p. 435], rust (*Puccinia pruni-spinosae*) [loc. cit.], brown rot (*Sclerotinia fructicola*) [35, pp. 352, 375], shot hole (*Clasterosporium carpophilum*) [cf. 35, p. 377], and deficiencies of nitrogen, calcium, iron, and potassium on peaches and nectarines in Tasmania. The following control methods are recommended for the fungus diseases: destruction of diseased prunings and mummified fruit; an early winter spray and, especially, a bud burst spray of 6–4–40 Bordeaux mixture and one at petal fall of T.M.T.D. (thiram). In addition thiram sprays in mid October, November, and December are required against rust and also prevent late leaf curl infection; thiram applied four and two weeks before harvest prevents brown rot infection of the fruit.

Nitrogen, potassium, and calcium deficiencies are to be rectified by soil dressings, and iron by spraying with ferrous sulphate (1 oz. to 4 gals. water). Peaches and nectarines require especially good drainage.

Angell (H. R.). **Brown rot of stone fruits. III. Incidence on the Phillips Cling Peach on light and heavy soil types in 1955.**—*J. Aust. Inst. agric. Sci.*, 21, 3, pp. 180–182, 1955.

Further observations in 1955 on brown rot (*Sclerotinia fructicola*) of peaches [*R.A.M.*, 35, p. 375] of the variety Phillips Cling after 8½ in. of rain a fortnight before picking at Shepparton, Victoria, Australia, confirmed the writer's previous opinion that the disease, the first of a series of plant reactions to waterlogging at harvest time which may culminate in death of the tree, is more serious on lighter soils that become waterlogged than on heavier loams and clays into which less water penetrates. It is suggested that proneness of fruit formed on lighter soils to brown rot is continued in storage.

Baxter (P.). **Manganese excess in Peach trees.**—*J. Aust. Inst. agric. Sci.*, 21, 3, pp. 170–172, 1955.

Golden Queen peach trees growing at the Horticultural Research Station, Tatura, Victoria, Australia, on a typical Goulburn Valley loam, developed leaf symptoms of manganese excess [cf. *R.A.M.*, 34, p. 72; 35, p. 42, *et passim*], which took the form of an interveinal chlorosis resembling that due to manganese deficiency. On some trees the leaves developed a marbled or blotchy chlorotic pattern. On many affected leaves the margin was inrolled and red with small red spots elsewhere on the leaf surface. Annual growth tended to be reduced, though fruit yields remained unaffected. Leaf analyses revealed a manganese content of 787 and 1,350 p.p.m. in mildly and severely affected leaves, respectively; below 600 p.p.m. no abnormal leaf symptoms were present.

Excessive uptake of manganese was attributable to acidification of the soil (pH 4·5 to 6) as a result of yearly applications of ammonium sulphate (3½ and 7 cwt. per acre) for about eight years. Spraying with sulphur compounds may also

have been contributory. Liming resulted in the non-appearance of leaf symptoms in subsequent years.

Takai (S.). **Physiological studies on Phellinus pomaceus (Pers.) Quél. causing the white rot of stems of Peach.**—*Forsch. PflKr., Kyoto*, 5, 3, pp. 119–125, 1 diag., 4 graphs, 1955. [Japanese, with English summary.]

Phellinus [*Fomes*] *pomaceus* is a destructive pathogen of peach in Japan, where it causes white rot of the heartwood, collapse of the twigs, and splitting of the crotch. The optimum temperature range for mycelial growth appeared to be from 26° to 30° C., at which the best results in inoculation tests on wood blocks of beech and peach were also obtained.

The phenol-oxidase reaction of the fungus was positive, guaiacol, gallic acid, phloroglucinol, pyrogallol, resorcinol, tannic acid, and tyrosine turning brown to reddish on agar media. The crude enzyme solution extracted from macerated mycelial mats in water caused the most extensive hydrolysis of cellulose at 40° and pH 4·5. No growth was made on nutrient agar with lignin as the sole source of carbon, but the addition of sucrose resulted in profuse development. A strain of the fungus that had adapted itself to growth on lignin in this way did not grow so well on cellulose-containing media as the original isolate.

Bovey (R.). **L'enroulement chlorotique, une nouvelle maladie à virus du Pêcher.** ['Chlorotic roll', a new virus disease of the Peach.] —*Rev. rom. Agric.*, 12, 5, pp. 42–43, 3 figs., 1956.

The author describes a disease of peach in Léman and Ticino, Switzerland, which he considers to resemble closely that caused by peach yellow leaf roll virus [*R.A.M.*, 33, p. 433]. He has transmitted the disease by grafting. Among the symptoms described are a feeble growth of affected shoots, though the first leaves appeared normal; stunting of the internodes; partial leaf fall in summer, the remaining leaves being small; curling of the leaves inwards about the midrib, with progressive yellowing at the edges as the season advances; reddish coloration of the veins, the tissues adjacent being a bronzed pale green, sometimes flecked with red; and some premature fall of the fruits, those remaining being small and of disagreeable taste.

Lee (W. O.) & Timmons (F. L.). **Chemical control of Chokecherry.**—*Down to Earth*, 11, 4, pp. 4–5, 2 figs., 1956.

Chokecherry (*Prunus virginiana*), which grows abundantly in canyons and on the foothills of the Intermountain West of the United States, is an important source of [peach western] X-disease virus [strain of peach X virus], transmitted by the leafhopper *Colladonus geminatus* [*R.A.M.*, 35, p. 464]. The trees can be eradicated by use of foliage sprays containing low volatile esters of 2,4-D, or mixtures of 2,4-D and 2,4,5-T at a concentration of 2,000 p.p.m. (0·2 per cent.) by weight in water. Treatments each year at the full blossom and leaf stage in early June usually suffice to kill 90 per cent. of the trees within two years. Ammonium sulphamate and 2,4-D amine were not effective.

Heinis (J. L.). **Correlation of ring spot virus reactions on stone fruits and Cucumber.** —*Phytopathology*, 46, 3, pp. 163–167, 3 figs., 1956.

At the Oregon Agricultural Experiment Station a virus was mechanically transmitted to National Pickling cucumbers from 20 out of 23 cherry trees, of which 22 were infected by necrotic ring spot virus [*R.A.M.*, 35, p. 616]. The degree of transmission varied with different selections and sources of inocula, being highest (34·6 per cent.) from infected cucumber leaves, followed by [*Prunus*] *mahaleb* (34·3) [35, p. 464], peach (25·3), and cherry (14·3) tip leaves. Flower petals gave low

percentages of transmission (4·8 and 7·7 from *P. mahaleb* and cherry, respectively). A close correlation of severity was found between the reactions of Bing sweet and flowering cherries, J. H. Hale peach, and cucumber, suggesting that the virus recovered on the last-named is the ring spot virus of stone fruits.

Heinis (J. L.). **Cherry viruses in Oregon in 1954 and 1955.** -*Proc. Ore. hort. Soc.*, 47, pp. ?, 1956. [Author's abstract.]

A survey in Polk county, Oregon, in 1952, disclosed the following sour cherry viroses: decline, characterized by orange-coloured, small fruits; pseudo-little cherry, producing branches with green cherries; and bumpy fruit, rough with necrotic spots in the flesh. In 1954, 3·6 per cent. of the trees showed one of these diseases and in 1955, 4·3 per cent. A sweet cherry survey in north-eastern Oregon established the spread of lace leaf, mottle leaf, little cherry, rasp leaf, and deep suture viruses, while necrotic rusty mottle was found in the south.

Geard (I. D.). **Progress report on berry fruit spraying trials.**—*Tasm. J. Agric.*, 26, 3, pp. 243–253, 4 figs., 1955.

The author describes the results of spraying trials to control diseases of raspberries and loganberries in Tasmania [*R.A.M.*, 28, p. 528]. Anthracnose (*Elsinoe veneta*) may be controlled by spraying at green tip (buds $\frac{1}{2}$ to 1 in.) and at white bud (flowers about to open). Bordeaux mixture, TMTD [thiram], SR 406 [captan], and ferbam are all effective at both stages. DNOC is effective at green tip, but causes severe foliage injury if used later. Copper oxychloride proved inferior.

Raspberry leaf rust (*Phragmidium rubi-idaei*) was effectively controlled only when Bordeaux was applied at the white bud stage. Spur blight (*Didymella applanata*) was reduced by the schedule for the other diseases.

The trials also covered black currant leaf spot (*Septoria ribis*), for which Bordeaux mixture and DNOC were effective green tip sprays and the former, captan, and thiram when the fruit was half grown, though Bordeaux is not recommended as it may reduce the vitamin C content of the fruit.

Lihnell (D.). **Något om förekomsten av Hallonviroser i Sverige.** [Something about the occurrence of Raspberry viroses in Sweden.] —*Nord. JordbrForskn.*, 36, 1–4, pp. 301–304, 1954.

Information on the classification of raspberry viroses according to the system of Harris *et al.* in Great Britain [*R.A.M.*, 31, p. 192 *et passim*] is followed by an account of preliminary observations at the Swedish Plant Protection Institute, Stockholm, on their occurrence in material, mostly of the Asker, Lloyd George, Preussen, and Marlborough varieties, obtained direct from growers in various districts. Of a total of 45 samples, 22 were found to be heavily infected by mosaic, mostly of the vein-chlorosis type, with a few cases suggestive of veinbanding. Symptoms developed in 107 of the 450 plants (roughly 25 per cent.) of all varieties except Asker.

Frazier (N. W.) & Posnette (A. F.). **Leafhopper transmission of a Clover virus causing green petal disease in Strawberry.**—*Nature, Lond.*, 177, 4518, pp. 1040–1041, 1 fig., 1956.

In several localities in Kent where strawberry green petal disease occurs [*R.A.M.*, 32, p. 632], aster yellows symptoms [35, p. 467] were also found in red and white clover (*Trifolium pratense* and *T. repens*), plantain (*Plantago major*), and mayweed (*Anthemis cotula*). Accordingly, miscellaneous leaf-hoppers from in and near strawberry fields were caged on diseased plantain and clover plants. Mixed colonies of *Euscelis lineolatus* and *Macrosteles viridigriseus* infected nine out of 12 clover, four of six *A. cotula*, and one of three celery plants. In separate tests with these two species *E. lineolatus* colonies infected nine out of 14 clover plants, nine more trans-

missions being secured with single insects. Only one definite transmission, to *A. catula*, occurred with *M. viridigriseus*. Both species failed to infect the strawberry and *Duchesnea indica* test plants. Dodder (*Cuscuta subinclusa*) transferred the virus from clover to strawberry and *D. indica*, which developed the leaf and flower symptoms characteristic of green petal disease. Lassen strawberry plants developed identical flower symptoms whether infected by dodder from clover or by grafting to strawberry infected with green petal.

It would appear, therefore, from these results that green petal may be caused by a strain of aster yellows virus, though the symptom differences on all hosts imply a distinction between the green petal and the eastern and western aster yellows viruses [35, p. 467]. The frequent occurrence of the disease in isolated strawberry fields suggests that it may be widespread in clover. Infected red clover plants are stunted and have yellow leaf margins and veins; a proliferation of axillary buds occurs. White clover, though developing clear symptoms, seems less sensitive than red, many plants of the latter having died within a few months of infection.

Climax Strawberry. 'Yellows'.—*Tasm. J. Agric.*, 26, 3, p. 228, 1955.

The recent occurrence of transient yellows and streak on Climax strawberries [cf. *R.A.M.*, 34, p. 733; 35, p. 377] in Tasmania is noted. Growers propagating their own plants are advised to discard those showing symptoms.

RAMAKRISHNAN (T. S.) & DAMODARAN (S.). **Observations on the wilt disease of the Banana.**—*Proc. Indian Acad. Sci.*, Sect. B, 43, 4, pp. 213–222, 2 pl., 1956.

The wilt disease (*Fusarium oxysporum* var. [f.] *cubense*) of bananas is growing in importance in India [*R.A.M.*, 32, p. 324]. First reported from Chinsurah in 1911 it has since been increasingly noted in Bombay, Madras, and Hyderabad. In Bombay the Kali and Basrai varieties are resistant. In Madras, where over 100 varieties are grown, Monthan, Rasthali, Pachanadan, and Tirunelveli suffer more from wilt than does Poovan.

The authors examined the reactions to wilt of 20 varieties, grown in large pots. The inoculum was added to the soil, either as a spore suspension or as pieces from cultures, when the plants were established. Poovan, Moongil, Peyladen, Rajabale, and Vamanakele were resistant under the conditions of the experiment. The susceptible varieties, when not killed, were stunted.

Experiments in which the fungus was cultured in the presence of the sap of various resistant varieties indicated that resistance cannot be explained by an inhibitory influence of the sap, but must be attributed to some other factor.

Attempts to infect a number of other crop plants, some chosen because they were related to banana, and others because they were attacked by other species of *Fusarium*, were unsuccessful.

Lime added to the soil inactivated the fungus in about two months [cf. 25, p. 3].

KHAN (A.). **A newly recorded leafspot disease of Fig in Pakistan.**—*Pakist. J. sci. Res.*, 6, 2, pp. 78–79, 2 figs., 1954.

The author describes the leaf spot caused by *Ormathodium fici* [*R.A.M.*, 28, p. 180] on a wild fig, probably *Ficus palmata*, at an altitude of 3,000 ft. in east Pakistan. This appears to be a new disease record for the subcontinent of Indo-Pakistan.

ZENTMYER (G. A.) & BINGHAM (F. T.). **The influence of nitrite on the development of Phytophthora root rot of Avocado.**—*Phytopathology*, 46, 2, pp. 121–124, 2 graphs, 1956.

In further studies on avocado root rot (*Phytophthora cinnamomi*) [*R.A.M.*, 34, p. 381; 35, p. 30] at the Citrus Experiment Station, Riverside, California, the

toxicity of nitrite nitrogen to both pathogen and host increased with rising acidity from pH 6·5 to 4·5 in synthetic nutrient solutions and on maize meal agar. About ten times as much nitrite was required for retardation of mycelial growth and inhibition of zoospore germination at the former as at the latter pH. In solution culture tests in the greenhouse the development of the fungus on seedlings of the Mexicola variety was prevented by the presence of 2 p.p.m. nitrite at pH 4·5, whereas at 6·5, 40 p.p.m. was requisite. The results of the tests yielded no evidence that nitrite predisposes avocado roots to attack by *P. cinnamomi*, which was, in fact, more sensitive to its toxic action than the host.

Excess soil moisture appears to be an important factor in the root rot syndrome, chiefly by facilitating sporangial production and the release and germination of zoospores.

Wallace (G. B.), Jenkins (Anna E.), & Bitancourt (A. A.). **Estudos sôbre as Miriangiales. VI. Verrugose do Mamoeiro, causada por Sphaceloma.** [Studies on the Myriangiales. VI. Scab of Papaw caused by *Sphaceloma*.] —*Arq. Inst. biol., S. Paulo*, 22, pp. 79–86, 2 pl., 1 fig., 1955. [English summary.]

Descriptions are given of the symptoms of papaw scab in Tanganyika and of the morphological and cultural characters of the causal organism (*Sphaceloma papayae* n.sp. Jenkins & Bitancourt) [*R.A.M.*, 34, p. 577], followed by a brief account of the results of inoculation experiments.

On six-month old plants (to which the observations were confined) the first signs of infection were yellow or pale green spots, subsequently turning white, on the leaves. Both leaves and stems may be misshapen, the latter swelling and becoming defoliated. The spots were most numerous on the upper leaf surface and either scattered all over or frequently concentrated at the tip or along the veins. They were circular or slightly irregular, prominent, with a well-defined margin, and measured 0·2 to 1 mm. in diameter, sometimes coalescing and becoming necrotic. The same process occurs on the petioles and stems, on which the lesions are frequently elongated.

On potato dextrose agar the colour of the colonies gradually turns from chamois to ochraceous buff by the 15th day and at the 35th to vinaceous buff, with a distinct yellow marginal growth. Besides the pale yellowish conidia observed in nature, others appeared in culture as glistening pustules on the surface. They were obclavate, oblong-ellipsoid to cylindrical, apiculate, spherical, or rarely acuminate, measuring 6 to 14 by 3 to 4 μ, and borne on irregular conidiophores, 6 to 12 by 4 to 5 μ, erumpent through the epidermis. Inoculation experiments on papaw gave positive results, with reisolation of the fungus.

It might be feasible to combat the disease by lowering humidity in the plantation through suppression of weeds and selection of a site distant from dense windbreaks, while spraying would also probably be effective.

Jacks (H.). **Orchard spray trials in 1954–55.**—*Orchard. N.Z.*, 28, 10, *Suppl.*, 15 pp., 1955.

Detailed information is given of the 1954–5 fungicidal and insecticidal spray trials [cf. *R.A.M.*, 34, p. 374] on deciduous fruit in New Zealand. Against apple black spot [scab: *Venturia inaequalis*] on Parlin's Beauty in Auckland all schedules were better than no treatment (34·6 per cent. infected fruit). flit 406 (50 per cent. captan) at 3 lb. for the first four sprays and 2 lb. for the next five and nirit ($7\frac{1}{2}$ and 5 lb.) both reducing infection to less than 1 per cent., with no spray damage. In a comparison of the most successful schedules in commercial use on Granny Smith, flit 406 (four sprays at 3 lb. followed by one at 2 lb. in association with eight of murphos —a parathion product) gave the best results (0·3 per cent. infected fruit, compared with 3·1 from the lime-sulphur schedule); next came venturicide (three at 2 lb.)

combined with thirospray (one at 2 lb.) with 0·6 per cent. infection. The latter also gave the best control of *Glomerella* [*cingulata*] on the fruit. At Nelson flit 406 followed by DDD reduced scab on Granny Smith from 5·2 (unsprayed) to nil.

Against brown rot (*Sclerotinia fructicola*) of Golden Queen peaches in Auckland eight applications of flit 406 (2 lb. for first and fifth and 1 lb. for the rest) reduced percentage fruit infection from 14·8 (unsprayed) to 1·7, the figures for ascospray (2 lb. for the first four) followed by flit being 2·6, and for a schedule of thirospray (two sprays), tetram (two), and flit (four) 2·3.

Fabraea scald (*Fabraea maculata*) reached 100 per cent. on the fruit of four varieties of quince in Auckland. It was reduced to 5·9 per cent. by thiotox (one spray at 2 lb. and nine at $1\frac{1}{4}$ lb.), to 6·4 by flit 406 (3 lb. and 2 lb.), and to 15·8 by tetram (2 lb. and $1\frac{1}{4}$ lb.).

Martin (J. T.) & Pickard (J. A.). **Spray application problems : XIII. Determination of captan deposits : progress report.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 83–89, 2 graphs, [1955].

In further studies in this series [*R.A.M.*, 34, p. 600 and following abstracts] captan residues on strawberries, apples, and pears were investigated at Long Ashton Research Station, Bristol. Three captan applications at 0·125 and 0·25 per cent. to strawberries to control *Botrytis* mould [*B. cinerea*: 35, p. 307] gave deposits of 10 and 20 p.p.m., respectively. One application, late in the season, at 0·1 per cent. to apples and pears left deposits of about 1 p.p.m., which became negligible at harvest. Captan persisted well under the rainfall conditions, which were slightly above average, during the trials.

Somers (E.). **Spray application problems : XIV. Laboratory and field experiments with Burgundy mixtures.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 90–96, 1 graph, [1955].

In a further contribution to this series [see preceding and following abstracts] the tenacity and fungicidal value against potato blight (*Phytophthora infestans*) [*R.A.M.*, 34, p. 172] of different Burgundy mixtures were compared in the field with Bordeaux mixture as a standard treatment. The tenacity of Burgundy mixture or cellulose acetate on glass slides, determined in a laboratory wash apparatus, was appreciably lower than that of Bordeaux mixture (10:12·5:100) only for the 10:10:100 and 10:40:100 concentrations. The 10:14:100 Burgundy mixture was the most suitable for application to potato foliage, was as effective as Bordeaux mixture of equivalent copper concentration in reducing blight, and is simpler to prepare and apply.

Morgan (N. G.) & Martin (J. T.). **Spray application problems : XV. Copper and DDT deposits from large and small volume application.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 97–105, 2 pl., 2 diags., [1955].

In further studies in this series [see preceding and following abstracts] three different spray applications, namely, two from a row-crop hydraulic machine at the rates of 98 and 45 gals. per acre and one from an experimental air-flow mist sprayer at 40 gals. per acre, were tested to determine copper deposits (Burgundy mixtures of different copper concentrations) on potato foliage. The disk used for the large volume spraying was of $\frac{4}{64}$ in. diameter aperture and for the small-volume $\frac{2\frac{1}{2}}{64}$ in. During the experiment the terminal portions of the haulms were erect and the remainder prostrate. An examination of leaflet pairs taken at random soon after the spray had dried, from the top and middle of the haulms of five plants in each treated block, showed that the coverage varied from 16 to 23 per cent. and in the region of the most dense deposit it was less than 30 per cent. With all the three methods of application most of the copper was deposited on the upper surfaces of

the leaves. The deposit given by the air-flow method was, however, appreciably greater than that obtained with small volume hydraulic application. Tests, made to determine the proportion of deposit retained by the foliage by placing paper sheets beneath the haulms and on open ground and spraying with Burgundy mixture (1·25 per cent. copper), revealed that in the open the loss by drift amounted to about 10 per cent. from the large volume application and 80 per cent. from the small.

Furmidge (C. G. L.). **Spray application problems : XVI. The evaluation of an average droplet diameter in sprays. XVII. The measurement of spray droplet size in the field.**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 106–117, 6 diags., 2 graphs; pp. 118–130, 1 pl., 6 graphs, [1955].

In further investigations on spray application at Long Ashton Research Station, Bristol, [see preceding and following abstracts], several methods of calculating the average diameter of droplets were tested, including the mass median diameter and the Sauter mean diameter. The contour diagrams of the spray pattern produced by these figures were compared with the spray distribution pattern of volume and of arithmetic mean diameter, the two most important factors in spray patterns. The most satisfactory average droplet diameter (d_0) was given by

$$d_0 = \sqrt[3]{\frac{6V}{\pi N}}$$

where V is the total volume of the droplets in the sample and N their total number.

In the field studies the author compared the accuracy of a number of methods of measuring spray droplet sizes. Though a means for direct measurement in the field has yet to be devised, the best available methods are those in which the spray is collected on a suitable surface where the droplets form either individual impressions or stains of a size bearing a direct relationship to that of the droplets [cf. *R.A.M.*, 32, p. 635]. Various methods, including impressions in magnesium oxide and the staining of different types of paper surfaces, a clean glass surface, or plaster of Paris were compared. For the measurement of individual droplets in comparing stain size and drop size drops were allowed to fall into a cell, the base of which was covered by a thin layer of grease (24 per cent. vaseline mixed with 76 per cent. medicinal paraffin), and covered with medicinal paraffin immediately after landing, to eliminate evaporation. The stain size distribution was compared with the actual drop size distribution, using the Rosin-Rammler expression to plot both, and it is important that this be done for each formulation of spray to be used. The chief factors influencing the ratio of stain size to drop size include the absorption of the drop by the collecting surface, the momentum of the drop as it strikes the surface, and the angle of impingement on the surface. None of the methods tested gave entirely accurate results over the whole range of field conditions. For most field work, however, the magnesium oxide method appears satisfactory provided the spray droplets are not too large and the slides are placed where the spray will impinge vertically on the collecting surface; stain methods on filter paper and plaster of Paris are, however, both easier to use and are sufficiently accurate with all but the smallest droplets.

Kearns (H. G. H.) & Morgan (N. G.). **Spray application problems : XX. Lightweight small power sprayers (34 and 70 c.c. I.C. engines).**—*Rep. agric. hort. Res. Sta. Bristol, 1954*, pp. 138–146, 2 pl., [1955].

There is an increasing demand for efficient and simple small power spraying machinery, particularly in overseas territories. The present power units employed are generally 4-stroke engines, difficult to transport in hilly country, so that spray fluid is often pumped through considerable lengths of hose, and they often have

a delivery of 2 to 4 gals. per minute when only ½ to 1 gal. per minute is required at the nozzle. In addition, maintenance requirements may be complex. Therefore two small, two-stroke internal combustion engines with a tubular frame and gear pump have been designed at Long Ashton Research Station, Bristol. The faulty starting of this type of engine has been overcome, they are more portable and simple to maintain, and should give 800 hours service before needing a major overhaul, costing about £5. Full details are given of the specification of the pumps, performance, operation, and maintenance. The smaller machine consists of a 34 c.c. engine and a ⅜-in. B.S.P. gear pump; it weighs 33 lb. and has a throughput of 8 pints per minute at 75 lb. per sq. in. The larger one, weighing 55 lb., has a 70 to 80 c.c. engine, a ½-in. B.S.P. gear pump, and a throughput of about 19 pints at 75 lb. The pumps are fitted with plastic bearings suitable for water lubrication.

HOARE (E. R.). **The spraying machine as a part of the pathological control.**—*Commonw. phytopath. News*, **2**, 2, pp. 20–23, 4 figs., 2 diags., 1956.

Spraying machines can generally be classified as (*a*) high pressure and large volume, (*b*) medium volume with medium droplet size, or (*c*) small volume and small droplets. The relative advantages of each for different spraying requirements are discussed. Current research is being carried out principally with the third type.

It is emphasized that the correct performance of a machine cannot be assessed until large-scale commercial tests have been made, in which machine variability is minimized and the degree of control related to the actual density and distribution of spray material on the crop, rather than to output [cf. preceding abstracts].

STOBWASSER (H.). **Untersuchungen über die Möglichkeit der Verneblung von fungiziden Pflanzenschutzwirkstoffen.** [Studies on the possibility of producing aerosols of fungicidal plant protectives.]—*Z. Aerosol-Forsch.*, **3**, 5–6, pp. 461–481, 5 figs., 1954. [Received 1956.]

Working at the Agricultural College, Stuttgart-Hohenheim, Germany, the author studied the possibility of applying various fungicides by means of an aerosol apparatus or 'pistol', using nitrogen gas at 10 to 25 atmospheres and temperatures of 400° to 500° C. Droplet deposition was studied on test slides in spray chambers I m. square. The density of cover achieved [cf. above, p. 693] was estimated indirectly by staining the deposited particles and estimating colorimetrically. Particle size was measured under the microscope.

Spores of *Alternaria tenuis* sprayed on to the test slides were used in biological tests. Three forms of copper oxide were tested, namely, commercial red copper oxide, collavin, and commercial, ready-made spray mixtures. When dissolved in naphthalene at 100° with a little beeswax all worked well. They were adversely affected by the inclusion of *gamma*-BHC which appeared to 'mask' the copper compound. Red copper oxide with copper acetate in naphthalene was more effective than the oxide alone in tests against *A. tenuis*. The acetate was included because it is water soluble and so offers a more effective barrier to germination than does the insoluble oxide, though the latter is rain-fast. At a dosage equivalent to 500 gm. per ha. the germination of *A. tenuis* was reduced to 10 per cent. Slide tests were also carried out with *Ustilago zeae*, the spores of which were sown on thin agar films previously exposed to the spray. *U. zeae* was more resistant, but could be equally controlled by higher concentrations. The action of rain on the oxide-acetate cover was tested by exposing treated slides in the greenhouse to occasional sprinklings with water and observing the germination of *A. tenuis* spores. The fungicidal activity of unsprinkled slides remained constant throughout the experiment. Sprinkled slides showed, surprisingly, increased activity, in spite of the loss of the copper acetate. The author thought that this might be due to evaporation of

the remaining naphthalene and *gamma*-BHC, where present, and possibly also to activation of the oxide under the influence of dampness and carbon dioxide.

Mixtures of copper salts of saturated and unsaturated high fatty acids were also tested. These were melted at 80° to 120° and dispersed by gas at 300°. Droplet size was larger than that of the oxides (only 70 to 90 per cent. were under 10 μ and some reached 40 μ), the copper content was low (not 10 per cent.), and the droplets tended to run together. Small quantities of the fatty acids had an appreciable effect on *A. tenuis* (25 gm. copper per ha. reduced germination by 24 per cent.) but the effect did not increase proportionately with the concentration (345 gm. copper per ha. reduced germination by 46 per cent.). Celery in spray chambers in which the air was circulated by a fan was sprayed with the fatty acid compounds and then inoculated with *Septoria apii*. At 600 to 700 gm. copper per ha. infection was reduced by 80 per cent. Almost complete protection could be achieved, but not at economic levels of application. The deposition of droplets on both sides of the leaf in turbulent air was confirmed by slide tests.

Commercial preparations of thiram and captan, dissolved in naphthalene, were both successful. Provisional field trials with captan against *S. apii* on celery and *Plasmopara viticola* on vine showed promise. Flowers of sulphur dissolved in naphthalene had no effect on *A. tenuis*. The author considers that further tests against other fungi are desirable.

Pote (H. L.) & Thomas (W. D.). **An apparatus for testing fungicides in a soil column.**—*J. Colo.-Wyo. Acad. Sci.*, 4, 6, pp. 49–50, 1954.

An apparatus developed at the Colorado A & M College to test the effects of different soils on the toxicity of fungicides consists of a glass tube, measuring 35 mm. inside diameter and 30 cm. in length, with a disk of filter paper 35 mm. in diameter inserted into the base, affixed by a wire screen. The entire base assembly is inserted into a glass cup, held in place by a rubber collar, and the tube is filled with sufficient oven-sterilized soil to provide a column of any length up to 25 cm. Fungicides may be mixed with the soil and then leached into the cup by adding water, the extract thus collected being used for a standard plate disk test of toxicity. Soluble fungicides tested in a 5-cm. column have moved through the soil with no apparent change in toxicity.

Seed treatment for disease control.—*Tasm. J. Agric.*, 26, 1, pp. 42–46, 1 fig., 1955.

This popular account of seed treatment describes the methods of application of wet steeps, dry dusts, and hot-water treatments, and gives the types of chemical employed in the first two. Recommended seed treatments for a number of ornamentals, vegetables, and cereals are listed in tabular form. For the control of antirrhinum rust (*Puccinia antirrhini*) [*R.A.M.*, 35, p. 351] and blind seed disease (*Phialea temulenta*) [29, p. 156; 33, p. 759] of rye grass [*Lolium* spp.] it is necessary only to store the seed for one and two years, respectively.

Mahapatra (G. N.). **Non-metallic fungicides.**—*Nature, Lond.*, 177, 4516, p. 938, 1956.

In an examination of the fungicidal properties of certain synthetic thiazoles and their derivatives at the Mayurbhanj Chemical Laboratory, Ravenshaw College, Cuttack, Orissa, 17 bromo thiazoles were screened for fungicidal activity by Montgomery and Moore's method [*R.A.M.*, 17, p. 405], using *Piricularia oryzae* as the test fungus. The 4 (*p*-hydroxyphenyl), 4 (α-naphthyl), and 4 (*p*-bromo phenyl),5-bromo thiazoles completely inhibited spore germination at concentrations of 20, 20, and 22 p.p.m., respectively. The unbrominated thiazoles inhibited germination at 90 p.p.m.

Specialpraeparater anerkendte af Statens Forsgsvirksomhed i Plantekultur til bekaempelse af plantesygdomme og skadedyr. Gyldig for året 1956. [Special preparations approved by the State Experimental Service in Plant Cultivation for the control of plant diseases and pests. Valid for the year 1956.]—*Tidsskr. Planteavl*, 59, 5, pp. 811–843, 1956.

This list of plant protectives officially approved for use in Denmark during 1956 is compiled on the usual lines [cf. *R.A.M.*, 34, p. 606].

Horsfall (J. G.). **Principles of fungicidal action.**—xx+280 pp., 2 diags., 5 graphs, Waltham, Mass., The Chronica Botanica Co.; London, W.C. 2, Wm. Dawson & Sons Ltd., 1956. $6.50.

This outstanding treatise by the Director of the Connecticut Agricultural Experiment Station comprises, besides a general introduction (containing a list of landmarks in the history of fungicides from B.C. 1000 to A.D. 1952) and a 28-page bibliography, chapters on fungicidal action and its measurement; protection and its measurement; mobilization of a residual protectant; permeation into the fungus; disruption of cellular organization; effect on mitosis, morphology, and growth; effect on metabolism of the fungus; chelation of needed metals; the action of metals; the action of sulphur; action of organic sulphur compounds; action of quinones and other ketones; the action of heterocyclic compounds; and chemotherapy of plant diseases.

The author is concerned throughout to distinguish between permeation and inherent toxicity. Descriptions are given of the physics and chemistry of protection and the mechanisms of toxicity to fungi that underlie effective protection. More information has been accumulated on this subject since the publication of the writer's 'Fungicides and their action' in 1945 [*R.A.M.*, 25, p. 128] than in all the preceding years. Antimetabolites, chelation, and physical toxicity have developed during the last decade from vague concepts into recognized working hypotheses. Included in the sections on dithiocarbamates, quinones, imidazolines, and trichloromethylthiophthalimidine are discussions of a number of new discoveries.

Hawker (Lilian E.). **Hypogeous fungi.**—*Biol. Rev.*, 30, pp. 127–158, 1955.

This comprehensive survey of the hypogeous fungi, chiefly from the literature (163 references), covers the earlier references to truffles, deals with their development, structure, and taxonomy, and describes their ecology and physiology.

[A full account of 'British hypogeous fungi' by the same author appeared in *Phil. Trans.*, B, 237, 650, pp. 429–546, 1954.]

Garrett (S. D.). **Biology of root-infecting fungi.**—xi+293 pp., Cambridge University Press, 1956. 30*s.* net.

This comprehensive book summarizes research on root-infecting fungi [*R.A.M.*, 29, p. 420; 35, p. 231] over the past 25 years. After an introductory chapter and a general account of the fungus flora of the soil the parasitic growth habit of soil- and root-inhabiting fungi, vascular wilt fungi, and mycorrhiza are dealt with. The relationship of rhizosphere microfloras to root infection and the various aspects of the saprophytic behaviour of root-infecting fungi are discussed. Chapters are devoted to the dormancy of root-infecting fungi and to different aspects of the epidemiology of root diseases, and finally to the control of such diseases. A bibliography of some 500 references is appended.

Ciferri (R.). **Manuale di Patologia Vegetale. Tomo III. Atlante delle principali malattie e parasiti delle piante coltivate.** [A manual of plant pathology. Volume III. An atlas of the chief diseases and parasites of cultivated plants.]

—49 pp., 67 col. pl. (each with explanations on opposite page), Rome, Società Editrice Dante Alighieri (Albrighi, Segati e C.), 1955. L.5,000.

This third and final volume of the present work [*R.A.M.*, 34, p. 663] contains 67 coloured plates of plant diseases and pests, of which 64 are reproduced from 'Malattie delle Piante Agrarie' [Diseases of agricultural plants] by the late Professor A. Brizi, second edition, Milan, 1941. The text, which is from the same source, but revised and condensed, serves as an elementary, practical introduction to plant pathology. The book can be used independently of the first two volumes.

Weyreter (B.). **Der hauptberufliche Pflanzenschutzwart des Dorfes.** [The senior village plant protection warden.] *Diss. Inst. PflSch. landw. Hochsch. Hohenheim*, 321 pp., 18 graphs, 4 figs., 1954.

The author reports his experiences during two years as a senior plant protection warden of a district in Württemberg, Germany [*R.A.M.*, 35, p. 113]. He describes advisory work amongst farmers, individually and collectively, in matters of crop health, and also the organization of collective pest and disease eradication schemes at village level.

Fifteen years of Geigy pest control. English Revised Edition. 150 pp., 126 figs., 4 graphs, 1 col. map, Basle, J. R. Geigy S.A., 1954.

This brochure is devoted to the recent achievements of the Geigy Company, of Basle, Switzerland, in the development of chemicals for plant protection, preservation of materials, and as insecticides, both contact and systemic, and other products. There is a section on the Experimental Farm at Pfeffingen. In the section on preservation of materials it is stated that the timber preservative bosan E. containing DDT [plus a fungicidal agent] is highly effective against the dry rot fungus, *Merulius lacrymans*. Work in the fungicide testing department has shown that *Alternaria tenuis* and *Phoma striiformis* are responsible for damage to apple buds as well as *Podosphaera leucotricha*. There is a bibliography of 116 publications by members of the Geigy staff and the 258 mentioned in the text.

Kilpatrick (R. A.) & Johnson (H. W.). **Sporulation of Cercospora species on Carrot leaf decoction agar.**—*Phytopathology*, 46, 3, pp. 180–181, 1956.

At the Delta Branch, Mississippi Agricultural Experiment Station, Stoneville, the following species of *Cercospora* produced conidia (mostly in moderate abundance) on carrot leaf decoction agar prepared by Diachun and Valleau's method in a modified form [*R.A.M.*, 20, p. 181], steaming without pressure: *C. brachiata* from *Amaranthus retroflexus*, *C. canescens* from *Dolichos lablab*, *C. capsici* from chilli (*Capsicum frutescens*), *C. festucae* from *Festuca arundinacea*, *C. kikuchii* from soy-bean, *C. penniseti* from *Pennisetum glaucum*, *C. pueraricola* from *Pueraria lobata*, *C. sesami* from sesame, *C. sorghi* from *Sorghum halepense* and sorghum, *C. stizolobii* from *Stizolobium deeringianum*, and *C. zebrina* from clovers (*Trifolium subterraneum*, *T. ambiguum*, and *T. incarnatum*). Particular attention was paid to *C. kikuchii*, which could not previously be induced to sporulate in culture [30, p. 503], isolates being obtained not only from the leaves (as in the other species) but also from the petioles, stigmas, stem, seeds, and funicule of soy-bean [35, p. 65]. In general, sporulation tended to be more profuse in dishes containing 25 to 40 ml. agar than in those with only 10 to 15 ml., and in daylight than in darkness.

Jones (W.). **Permanent mounts of fungus cultures on cellophane.**—*Phytopathology*, 46, 3, pp. 131–132, 4 figs., 1956.

A description is given of Fleming and Smith's method for the preservation of fungus cultures on cellophane disks [*R.A.M.*, 23, p. 351], which the author finds

very useful at the Plant Pathology Laboratory, Saanichton, British Columbia, for macro- and microscopic and photographic studies on new and old material alike. Mounts of ten years old and more have yielded good photographs. A small section is cut from the disk with scissors and one end held on a slide while a drop of 3 per cent. potassium hydroxide is added and until the cellophane, which may curl at first, straightens again. A cover-slip may now be added, or the mycelium floated off and placed on another slide for staining.

Galloway (L. D.). **The laboratory examination of mould fungi. Parts I, II, and III.** —*Lab. Practice*, 4, 3, pp. 102-105, 4 figs.; 4, pp. 144–147, 8 figs.; 5, pp. 193–196, 9 figs., 1955.

In part I of this series of three papers the author describes in popular terms methods of recognizing moulds and culturing them for examination, including reference to several modified methods of using transparent cellulose film [cf. preceding abstract]. Parts II and III deal with the identification of common genera of the Mucorales, Ascomycetes, and Fungi Imperfecti. A table is appended showing the position of the commoner moulds in a general classification of fungi.

Boedijn (K. B.). **Trypan blue as a stain for fungi.** —*Stain Tech.*, 31, 3, pp. 115–116, 1956.

Trypan blue proved very satisfactory as a stain for [unspecified] fungi, either as a quick-staining solution of 0·1 to 0·5 per cent. in 45 per cent. acetic acid or a slow-staining one at the same strength in lactophenol. Heating the preparations expedited the action of the dye in both cases.

Russell (P.). **A selective medium for the isolation of basidiomycetes.**—*Nature, Lond.*, 177, 4518, pp. 1038–1039, 1 fig., 1956.

A programme of work at Bowaters Development and Research, Ltd., Central Research Laboratories, Northfleet, Kent, involving the isolation of wood-rotting fungi from infected Scandinavian wood pulp [*R.A.M.*, 35, p. 409], was hampered by mould contamination. This difficulty has now been largely overcome by the development of a selective medium composed of 3 gm. 'oxoid' desiccated malt extract, 0·5 gm. 'oxoid' mycological peptone, 2·5 gm. agar, 0·006 gm. *o*-phenyl phenol, and 100 ml. distilled water. Phenyl phenol has given good results in isolating wood-rotting fungi from wood pulp and in conjunction with air-sampling apparatus. *Fomes annosus* was isolated from several localities by means of this medium together with four more basidiomycetes, at present unidentified, none of which was obtained by exposing plates of ordinary malt agar. One pulp sample yielded a strain of *Trichoderma viride* highly resistant to *o*-phenyl phenol. So far *Merulius lacrymans* is the only wood-rotting fungus that failed to grow on the medium, which can probably be used for isolating basidiomycetes from soil and from materials heavily infected with superficial moulds, such as wood pulp and bark, building boards, fresh water, pulp mill whitewaters, and the air.

Thirumalachar (M. J.). **Romanoa, nuovo genere di fungo del terreno con attivita' antibatterica.** [*Romanoa*, a new genus of soil fungi with antibacterial activity.] —*R.C. Ist. sup. Sanit.*, 17, 12, pp. 1323–1329, 3 pl., 1954. [French, English, and German summaries.]

A description is given of a new fungus isolated from soil near Rome. A member of the Clavicipitaceae, it is characterized by a white mycelium producing minute, superficial, hyaline, lageniform or vermiform perithecia with blunt apices. The aparaphysate, narrowly clavate asci contain eight filiform, septate ascospores and have a hyaline, gelatinous cap, the distinctive feature of the new organism. The fungus is close to *Ophionectria* and *Globulina* Speg., of which the former, however,

has globose perithecia, while in the latter they are globose without a stoma. A new genus, *Romanoa*, is accordingly erected, the type species being named *R. terricola* n.sp. Agar cultures displayed antibacterial activity against *Bacillus subtilis* and *Micrococcus pyogenes*.

Guyot (L.) & Montégut (J.). **Sur l'effet fongostatique sélectif de l'extrait aqueux de poudre de sommités fleuries d'Hellébore.** [On the selective fungistatic effect of the aqueous extract of powder from the inflorescences of Hellebore.]—*C.R. Acad. Sci., Paris*, 237, 2, pp. 200–202, 1953.

At low concentrations aqueous extracts of powder from the inflorescences of *Helleborus foetidus* [see next abstract] exerted a clear-cut selective action on micro-organisms of the soil and air on Czapek's medium, favouring the development of *Penicillium* spp., notably *P. chrysogenum* and *P. meleagrinum*, at the expense of other moulds, e.g., *Aspergillus*, *Fusarium*, *Monilia*, *Pestalozzia*, *Stysanus*, and *Trichoderma* spp. and bacteria. The fungistatic effects of the powder were most potent when the inflorescences were collected at the height of the season and used immediately.

Guyot (L.), Guillemat (J.), & Montégut (J.). **De l'effet biostatique sélectif exercé par certaines plantes phytotoxiques sur le microflore du sol.** [On the selective biostatic effect exercised by certain phytotoxic plants on the microflora of the soil.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 6, 2, pp. 119–163, 14 pl., 1955.

In studies conducted at the National School of Agriculture, Grignon, France, an aqueous extract of powdered roots of hellebore (*Helleborus foetidus*) [see preceding abstract] at 1 in 20 was fungistatic and in some cases fungicidal to *Alternaria solani*, *Aspergillus versicolor*, *Fusarium lateritium*, *F. oxysporum*, *Gliocladium roseum*, *Mucor* sp., and *Penicillium chrysogenum* on Czapek's liquid medium; it was also bacteriostatic [bacteria not specified]. Dried leaf extract (1 in 20) was fungistatic to certain species of *Acrostalagmus* [*Verticillium*], *Aspergillus*, *Botryotrichum*, *Chaetomium*, *Fusarium*, *Gliocladium*, *Hormodendron*, *Mucor*, *Myrothecium*, *Penicillium*, *Phoma*, *Sepedonium*, *Sporormia*, and *Volutella*; it also retarded the growth of bacteria and *Actinomyces* species. At 1 in 10 it retarded the growth of all the fungi studied except *Penicillium cyclopium*. Extract of flowering tips (1 in 20 to 1 in 100) more or less completely arrested the growth of bacteria, yeasts (*Torula* spp.), and many fungi present in the unsterilized, very dilute extract, though some species of *Penicillium* were resistant; species of *Mucor* were completely eliminated at concentrations of 1 in 500 to 1 in 10,000. The biostatic effect of the inflorescences was marked when they were obtained at full flowering time and used at once, but was greatly reduced when they were gathered or used late. At concentrations equal to or lower than those which produced the biostatic effects described above hellebore extract stimulated the growth of certain species of *Aspergillus*, *Fusarium*, and *Penicillium*. To mention a few examples: there was an increase of 55 per cent. in the diameter of colonies of *F. oxysporum* on Czapek's agar containing 1 in 500 or 1 in 1,000 parts of aqueous extract of the powdered inflorescences. *Chaetomium elatum* fructified more rapidly on a medium containing 1 in 100 to 1 in 50 aqueous dried leaf extract than without it.

Under the influence of the dual effect of the elimination of invading or retarding organisms (bacteria, yeasts, *Actinomyces* spp. and fungi such as *Mucor* spp.) and the stimulation of certain fungi such as *Aspergillus*, *Chaetomium*, *Penicillium*, and *Fusarium*, fungal-bacterial complexes submitted to the action of suitable dosages of the extracts underwent an appreciable selective effect. The result of this is to facilitate (*a*) the isolation of resistant organisms from the soil and rhizospheres of plants, (*b*) the detection of certain lower ascomycetes the growth of which might

have remained unnoticed on a medium without the extract, and (*c*) the qualitative and quantitative analysis of the fungal content of natural soils and culture media.

Aqueous extract of the pulped berries of *Lonicera xylosteum* at 1 in 100 eliminated bacteria and at 1 in 500 the actinomycetes in the soil microflora. Species of *Aspergillus*, *Fusarium*, and *Penicillium* were more resistant to this extract than to hellebore extract. In the presence of an aqueous extract of dried roots of wild cornflower (*Centaurea cyanus*) and wild charlock (*Sinapis arvensis*) at 1 in 15 to 1 in 160 the colony diameters of *F. oxysporum* increased by 75 per cent. and 100 per cent., respectively.

Gray (R. A.). **Increasing the absorption of streptomycin by leaves and flowers with glycerol.**—*Phytopathology*, 46, 2, pp. 105–111, 3 figs., 1956.

A preliminary account of the author's experiments on the use of glycerol to enhance the efficiency of streptomycin sprays in the control of bacterial blight (*Xanthomonas phaseoli*) on Pinto bean [*Phaseolus vulgaris*] has already been noticed from another source [*R.A.M.*, 35, p. 503].

As the antibiotic has also been used against tobacco wildfire (*Pseudomonas tabacum*) [33, p. 765] and bacterial spot (*Xanthomonas vesicatoria*) on tomato and [chilli] pepper [35, p. 413], the effect of glycerol on its absorption by these plants was also tested, with excellent results. Tested on quince flowers 1 per cent. glycerol increased by 2·2 times the absorption of streptomycin sprays (200 p.p.m.) used against *Erwinia amylovora* [33, p. 157; 35, p. 25], as determined by assays against *Escherichia coli*. In three similar tests with sprays containing 400 p.p.m. of the antibiotic, glycerol resulted in 4·8, 5·4, and 9·2 times increased absorption, respectively.

Sorbitol, diethylene glycol (both at 2 per cent.), and other polyhydroxy alcohols acted similarly to glycerol, but less powerfully, in promoting streptomycin absorption by bean leaves. Glycerol also exerted a favourable influence on the absorption of chloromycetin [chloramphenicol] and streptothricin by bean leaves.

Stodola (F. H.), Raper (K. B.), Fennell (Dorothy I.), Conway (H. F.), Sohns (V. E.), Langford (C. T.), & Jackson (R. W.). **The microbiological production of gibberellins A and X.** –*Arch. Biochem. Biophys.*, 54, 1, pp. 204–245, 1955.

The authors describe a method developed at the Northern Utilization Research Branch, Peoria, Illinois, for the production of crude crystalline gibberellin [*R.A.M.*, 34, p. 249 and next abstract] from the culture liquor of *Gibberella fujikuroi* on glucose, magnesium sulphate, ammonium chloride, and potassium dihydrogen phosphate, fermented in a 300 gal. tank. The yield was about 12 gm. per 160 gal. of culture liquor.

Borrow (A.), Brian (P. W.), Chester (V. E.), Curtis (P. J.), Hemming (H. G.), Henehan (Catherine), Jeffreys (E. G.), Lloyd (P. B.), Nixon (I. S.), Norris (G. L. F.), & Radley (Margaret). **Gibberellic acid, a metabolic product of the fungus Gibberella fujikuroi : some observations on its production and isolation.**—*J. Sci. Food Agric.*, 6, 6, pp. 340–348, 3 graphs, 1955.

The authors give a further account of investigations at the Akers Research Laboratories, Welwyn, Herts, on the production of gibberellic acid [*R.A.M.*, 35, p. 36 and preceding abstract]. Attention is drawn to the varying morphology of *Gibberella fujikuroi*. Evidence showed that synthesis of gibberellin and gibberellic acid was more common in strains of the fungus causing bakanae disease of rice than in those affecting other hosts.

Tveit (M. T.). **Heterothallism in Chaetomium spp. and its relation to antibiotic producing capacity.**—*Acta path. microbiol. scand.*, 37, 5, pp. 429–433, 1955.

Investigation of heterothallism in species of *Chaetomium* [*R.A.M.*, 32, p. 552]

and its relationship to antibiotic production [35, p. 601], carried out at Rutgers University, New Jersey, showed six out of 28 species tested to be heterothallic. Only one of these, *C. cochlioides*, and two of the homothallic species produced detectable antibiotic. No difference was found between plus, minus, and mated strains of *C. cochlioides* in their production of the antibiotic substance, chetomin.

Wright (Joyce M.). **Production of gliotoxin in soils.**—*Nature, Lond.*, 177, 4515, p. 896, 1956.

In studies at Imperial Chemical Industries, Ltd., Welwyn, gliotoxin [*R.A.M.*, 34, p. 168; 35, p. 476] was detected in pieces of wheat straw 1 in. long left for seven days in an acid Wareham Heath podsol inoculated with a spore suspension of *Trichoderma viride*. Approximately 1 μgm. was produced in each straw (13 μgm. per gm. straw) and in each gm. of soil immediately surrounding it. No gliotoxin was produced in straws buried in a Kettering loam of pH 6·3 unless either the straw or the soil was first acidified.

When mustard seeds were dusted with spores of *T. viride* in an attempt to protect the seedlings against soil-borne diseases, some of the cotyledons developed chlorotic patches probably due to the presence of gliotoxin in the seed coat. The testas of seeds dusted with *T. viride* spores and grown in John Innes potting compost for seven days induced inhibition zones in cultures of *B[acillus] subtilis*. Approximately 0·25 μgm. gliotoxin was produced per seed coat and 4 μgm. by pea seeds similarly treated. When these experiments were repeated with a fresh batch of potting compost it was found that an antibacterial and antifungal substance was produced on the uninoculated pea testas. This was because *T. viride* was present naturally in the soil.

Aytoun (R. S. C.). **The effects of griseofulvin on certain phytopathogenic fungi.**—*Ann. Bot., Lond.*, N.S., 20, 78, pp. 297–305, 2 pl., 1956.

In vitro and *in vivo* investigations were made at the Glaxo Laboratories Fermentation Research Division, Stoke Poges, Bucks, on the effect of griseofulvin [*R.A.M.*, 32, p. 492] on the hyphae of *Botrytis cinerea*, *B. allii*, *B. tulipae*, and *B. fabae*, growing out from spores, using the parallel hanging drop culture technique with a Winge micromanipulation cell, 2½ per cent. malt agar, and a 4 per cent. griseofulvin concentration dissolved in acetone added to the agar at 45° to 55° C. The effects *in vitro* were retardation of the growth rate, stimulation of branching, abnormal appearance of the hyphal protoplasm, and loss of rigidity of the hyphal membrane in the tip region. The antibiotic was not translocated within the mycelium. *In vivo* experiments on the control of the spread of *B. tulipae* inoculated on to the cut end of a tulip shoot by griseofulvin previously taken up by the roots, demonstrated that the fungus was unable to pass from cell to cell through the cell membranes. Penetration of onion bulb scale epithelium by *B. allii* was delayed for three days by 10 to 15 μgm. per ml. griseofulvin. All the hyphal modifications observed *in vitro* such as curling, stunting, and bursting were also observed *in vivo*.

Tsukahara (T.). **Studies on saké yeasts. Part 4. On restoring the sporulation ability of saké-yeasts.**—*J. agric. chem. Soc. Japan*, 28, 9, pp. 724–727, 2 graphs, 1954. [Japanese, with English summary.]

At the Society of Brewing, Japan, the ability of saké yeasts to sporulate was restored or strengthened by subculturing seven or eight times at two- to three-day

intervals in a koji extract medium sterilized by passing through a Berkefeld's filter, and then two or three subsequent subcultures at seven-day intervals.

WINDISCH (S.). **Beiträge zur Biologie und Systematik der Kahmhefen.** [Contribution to the biology and systematics of the pellicle-forming yeasts.]—*Arch. Mikrobiol.*, 21. 1. pp. 80–95. 1954. [Received April, 1956.]

Among 52 strains of pellicle-forming yeasts examined at the Technical University, Berlin-Charlottenburg, were seven belonging to *Candida guilliermondii*, *C. melibiosi*, *C. solani*, and *C.* (?) *scottii*, while the remainder were classified in three groups corresponding to *Pichia membranaefaciens*, *C. mycoderma*, and *C. krusei*. *P. membranaefaciens* differs from the other two groups in the production of spores, and *C. mycoderma* must actually be regarded as a non-sporulating type of the former species, from which it is essentially indistinguishable. *C. krusei* is clearly differentiable from *C. mycoderma* by the fermentation of glucose, an aberrant habit of pseudomycelial growth, and the assimilation of citric acid by all the strains investigated. *C. krusei* is a very common and easily determinable species, the role of which in the colonization or spoilage of beverages and foodstuffs is still imperfectly understood.

MITTON (R. G.) & TURNER (J. N.). **A study of mould growth on chrome-tanned leather, and the associated changes in physical properties.**—*J. Soc. Leath. Tr. Chem.*, 39, pp. 343–358, 1955.

In further studies of mould growth on tanned leather [*R.A.M.*, 31. p. 74] at the British Leather Manufacturers' Research Association, Egham, Surrey, full-chrome leather samples were submitted to different treatments, in which the amount of fungicide (*p*-nitrophenol) and type of oil (neatsfoot, or 90 per cent. cod oil plus 10 per cent. neatsfoot) and quantity added, the pH value of the water extract of the leather, and the temperature, humidity, and duration of storage were varied. Mould growth was less prolific than on vegetable tanned leather, appeared to reach a maximum after about six months, and was chiefly dependent on the humidity and temperature of storage, the amount of added oil, and the presence or absence of fungicide. The mould flora was more varied at the outset, but finally consisted of not more than four types of *Penicillium* (*P. frequentans* and a strain of *P. luteum* being commonest) with occasional colonies of *Aspergillus niger* [see following abstracts]. With lower humidity (87 per cent.), the addition of the fungicide actually caused a certain amount of mould growth in samples to which no oil had been added and which were stored at the lower temperature (24° C.) for three months. At 100 per cent. relative humidity this combination of treatments was the only one in which no mould appeared—a curious result.

Other moulds identified were *A. glaucus*, *A. repens*, *P. wortmanni*, and *Paecilomyces varioti*. It is important that if *p*-nitrophenol be added there is sufficient to prevent all mould growth, or worse staining may occur than without it, due to growth of alkali-producing *Penicillium* spp. Spore counts and measurement of the volume of spores on the surface [33, p. 43] indicated that the fungicide had little effect on moulds that had reached the fruiting stage, and that *Penicillium* increased in dominance after long storage.

In a subsidiary experiment the oil added during fat-liquoring at the tannery was removed by Soxhlet extraction and mould growth studied on samples otherwise treated as before or to which mineral oil alone was added. After about 11 months vigorous growth of *A. niger* was succeeded by overgrowth of *Penicillium*. In some samples a mould new to leather was found, *P. islandicum*, which caused deep red stains.

Mould growth caused little change in the physical properties of the leather, such as occurred being due more to modifications of the oil rather than of the fibres. The tensile strength was quite unaffected.

DAHL (S.). **Prevention of microbiological deterioration of leather.**—*J. Amer. Leath. Chem. Ass.*, 51, 3, pp. 103–118, 3 figs., 1956.

The oils and greases incorporated into leather during the tanning process provide excellent nutriment for moulds, especially *Aspergillus niger* [see preceding abstract], but if they are removed the leather becomes stiff and brittle and less useful. The methods used at the National Bureau of Standards, Washington, D.C., for the evaluation of fungicides to control this form of deterioration are described and the most effective types of compound indicated [see next abstract].

DAHL (S.) & KAPLAN (A. M.). **Laboratory and field exposure studies of leather fungicides.**—*J. Amer. Leath. Chem. Ass.*, 51, 3, pp. 118–136, 4 diags., 1956.

The efficiency of seven leather fungicides previously evaluated in laboratory tests at the National Bureau of Standards, Washington, D.C. [see preceding abstract], for the control of *Aspergillus niger* was studied under field conditions in Arizona (severe weathering) and the Isthmus of Panama (tropical jungle) in comparison with the standard 4-nitrophenol [cf. *R.A.M.*, 34, p. 665]. Besides the last-named, 2-chloro-4-nitrophenol, 4-thiocyanophenol, and bis(4-nitrophenyl) carbonate prevented mildew development at concentrations not exceeding 0·6 per cent. N-(trichloromethylthio)tetrahydrophthalimide and tetrachlorohydroquinone exerted a comparable effect in some tests but not in others, and cannot be regarded as dependable for the purpose in view, while 2-phenyl-phenol and 4-chloro-*m*-xylenol failed to confer protection even at concentrations well above 1 per cent.

WENGER (K. F.). **Light and mycorrhiza development.**—*Ecology*, 36, 3, pp. 518–520, 4 figs., 1955. [Received July, 1956.]

An investigation of loblolly pines (*Pinus taeda*) in Duke Forest, North Carolina, revealed a marked relation between the light intensity under which the seedlings were grown and the amount of mycorrhizal development [*R.A.M.*, 35, p. 87], there being far more mycorrhizal tips in full light. They were also more extensive in the A horizon, possibly because it contained far more carbohydrates than the B horizon.

HARLEY (J. L.). **The mycorrhiza of forest trees.**—*Endeavour*, 15, 57, pp. 43–48, 1 pl., 3 graphs, 1956.

Most of the information reviewed here with reference to the literature (12 titles) on mycorrhiza in temperate forest trees has already been noticed [cf. *R.A.M.*, 35, pp. 315, 534]. The author summarizes the modern concepts of mycorrhizal partnerships and their method of functioning in the light of studies by Björkman [23, p. 270], Melin [33, p. 747], and others [34, p. 802] on the intensity of mycorrhizal development and its relation to environment and on the means of uptake of nutrients, showing mycorrhizal roots to be highly efficient aerobic accumulators of ions.

NAITO (N.) & KUNIKATA (H.). **The specific growth phase in Gloeosporium olivarum on agar media containing 2,4-D.**—*Forsch. PflKr., Kyoto*, 5, 3, pp. 113–118, 1 fig., 1 diag., 8 graphs, 1955. [Japanese, with English summary.]

At the Kagawa Agricultural College, Japan, *Gloeosporium olivarum* [the agent of olive anthracnose] was cultured for 17 days at 25° C. on peptone agar containing 0·01, 0·015, 0·02, 0·06, or 0·32 per cent. 2,4-D [*R.A.M.*, 32, p. 325]. The growth curve of the fungus on these media was of the logarithmic type, indicating a progressive decrease in the rate of development, corresponding to an increase in the inhibitory activity of 2,4-D. On the other hand, the mycelial curve on media

containing either copper sulphate or uspulun was linear, resembling that of the control cultures without 2,4-D, and the inhibitory effect of the chemicals declined progressively.

When two colonies of the fungus were cultured in the same Petri dish at distances apart of 1 to 7 cm., contact always took place in the absence of 2,4-D. With the chemical there was a zone of inhibition 1·5 to 3 mm. wide, which was still present at the end of 30 days.

The results of another study by the authors having indicated that *G. olivarum* produces an antibiotic on media containing 2,4-D the phenomena here described are attributed to the action of this substance.

WITSCH (H. v.) & WAGNER (F.). **Beobachtungen über den Einfluss des Lichtes auf Mycel- und Conidienbildung bei Alternaria brassicae var. dauci.** [Observations on the influence of light on mycelial and conidial production in *Alternaria brassicae* var. *dauci*.]—*Arch. Mikrobiol.*, 22, 3, pp. 307–312, 1955.

The results of studies at the Technical College of Munich, Germany, revealed morphological and anatomical differences in mycelial structure between cultures of *Alternaria brassicae* var. *dauci* [*A. dauci*] isolated from wilted carrot leaves [see next abstract], maintained in light or darkness, while diffuse daylight and Osram fluorescent tubes with an illuminating power of 3,800 to 4,000 lux also acted divergently.

Conidial production fell into two phases, sterigmata being formed only under the influence of fluorescent (not incandescent) light, whereas an intervening period of darkness was requisite for the production of conidia.

WAGNER (F.). **Untersuchungen über die Einwirkung von 2,4-D- und MCPA-Präparaten auf Wachstum und Conidienbildung phytopathogener Pilze.** [Studies on the effect of 2,4-D- and MCPA preparations on growth and conidial production in phytopathogenic fungi.]—*Arch. Mikrobiol.*, 22, 3, pp. 313–323, 3 graphs, 1955.

At the Technical College of Munich, Germany, the author studied the influence of the herbicides 2,4-D and MCPA (2-methyl-4-chlorophenoxyacetic acid), supplied in the forms of 'hedonal liquid' and 'hedonal M liquid', respectively, by Bayer, Leverkusen, on the mycelial growth and conidial production of eight plant-pathogenic fungi cultured in a nutrient solution or on beerwort agar, viz., *Alternaria* sp. isolated from *Cercospora* [*beticola*] lesions on sugar beet leaves, *Botrytis cinerea*, *B.* sp. from head lettuce, *Helminthosporium* [*Pyrenophora*] *teres* from barley, *H. sativum* [*Cochliobolus sativus*] from an [unspecified] cereal, *Rhizoctonia* [*Corticium*] *solani* from potato, *A. brassicae* var. *dauci* [*A. dauci*] from diseased carrot leaves [see preceding abstract], a *Fusarium* sp. from cucumber, forming macro- and microconidia and chlamydospores, and *Sclerotinia* sp. from the same host.

All the pathogens proved to be highly resistant to the two compounds. Mycelial growth was invariably retarded but seldom suppressed entirely at a strength of 1·6 mg. per l., while a slight stimulus to vegetative development was afforded by 0·16 mg. per l., e.g., to *C. sativus* by MCPA and *C. solani* by 2,4-D.

MCPA at 16·6 mg. per l. gave a 14-fold increase of conidial production by *A. dauci*, while at 1·6 mg. it raised the conidial dimensions of *C. sativus* by 30 per cent. In another test the mycelial weight of *C. sativus* after eight days' culture in beerwort was increased from 93·4±0·8 (in the untreated) to 99±0·7 mg. by one hour's preliminary immersion of the conidia in a 0·1 per cent. MCPA solution.

The potential effects of herbicidal treatments on the spread of plant diseases are briefly discussed in the light of these findings.

PUBLICATIONS OF THE COMMONWEALTH MYCOLOGICAL INSTITUTE

THE REVIEW OF APPLIED MYCOLOGY

THE subscription to the *Review* for the current volume is 60*s.* per annum, post free, payable in advance. Back volumes can be supplied, but the price is 70*s.* per volume, postage extra, with the exception of a few parts, which are out of print. Volumes I to XII have been reprinted and are available at 70*s.* per volume. Microfilm copies of the volumes out of print can be supplied to order.

INDEX OF FUNGI (formerly SUPPLEMENTS TO THE REVIEW OF APPLIED MYCOLOGY)

AN INDEX OF FUNGI listing new species and varieties of fungi, new combinations, and new names published since the beginning of 1940 is published half-yearly. The cost of Vol. 1, Parts 1 to 20 and Vol. 2, Parts 1 to 11 (all published to the end of 1955) is 3*s.* 9*d.* each part. The subscription price is 7*s.* 6*d.* per annum.

The Cumulative Index for Volume I, comprising pp. 289–430, is now available at a price of 25*s.*, post free. Binding-cases in buckram for Volume I can be obtained at a cost of 5*s.*, post free.

Complete bound volumes of Volume I with the cumulative index are also available at a price of £5. 15*s.*

INDEX OF FUNGI. PETRAK'S LISTS FOR 1920–39. The following are now available: 1936–39, price 30*s.*; 1932–35 (original copies in Just's *Botanischer Jahresbericht*), price 45*s.*; 1931, price 10*s.*; 1930, price 25*s.*; 1929, price 10*s.*; 1922–28, price 40*s.*; 1921, price 10*s.*; 1920, price 10*s.*

DISTRIBUTION MAPS OF PLANT DISEASES

A SERIES of maps showing the world distribution of major plant diseases is now being issued at the rate of two maps each month. Of the 24 maps issued each year, six may be new editions, which in future cannot be issued free. The subscription price is 7*s.* 6*d.* per annum, post free. Back issues, in series, 5*d.* each; odd numbers 9*d.* each, postage extra. Loose-leaf binders for the maps are now available, price 20*s.*, postage extra. For a list of maps 1 to 282 see *R.A.M.*, **22**, p. 48; **23**, p. 80; **24**, p. 128; **25**, p. 96; **26**, p. 32; **27**, p. 96; **28**, p. 96; **29**, p. 112; **30**, p. 176; **31**, p. 160; **32**, p. 352; **33**, p. 654.

MYCOLOGICAL PAPERS

No. 44. STUDIES ON MICRO-FUNGI. X. *Zygosporium*. By S. J. HUGHES. 18 pp., 9 figs., 1951. 4*s.* 6*d.*

No. 45. STUDIES ON MICRO-FUNGI. XI. Some hyphomycetes which produce phialides. By S. J. HUGHES. 36 pp., 11 figs., 1951. 10*s.*

No. 46. STUDIES ON MICRO-FUNGI. XII. *Tripospormum*, *Tripospermum*, *Ceratosporella*, and *Tetrasporium* (gen. nov.). By S. J. HUGHES. 35 pp., 30 figs., 1951. 10*s.*

No. 47. STUDIES ON MICRO-FUNGI. XIII. *Beltrania*, *Ceratocladium*, *Diplorhinotrichum*, and *Hansfordiella* (gen. nov.). By S. J. HUGHES. 15 pp., 10 figs., 1951. 4*s.* 6*d.*

No. 48. FUNGI FROM THE GOLD COAST. I. By S. J. HUGHES. 91 pp., 32 figs., 1 map, 1952. 20*s.*

No. 49. STUDIES ON MICRO-FUNGI. XIV. *Stigmella*, *Stigmina*, *Camptomeris*, *Polythrincium*, and *Fusicladiella*. By S. J. HUGHES. 25 pp., 15 figs., 1952. 7*s.* 6*d.*

No. 50. FUNGI FROM THE GOLD COAST. II. By S. J. HUGHES. 104 pp., 49 figs., 1953. 20*s.*

No. 51. A SUPPLEMENT TO A LIST OF PLANT DISEASES OF ECONOMIC IMPORTANCE IN TANGANYIKA TERRITORY. By G. B. WALLACE and MAUD M. WALLACE. 7 pp., 1953. 3*s.*

No. 52. A HOST LIST OF PLANT DISEASES IN MALAYA. By A. THOMPSON and A. JOHNSTON. 38 pp., 1953. 10*s.*

No. 53. THE PLANT DISEASES OF NYASALAND. By P. O. WIEHE. 39 pp., 1 map, 4 graphs, 1953. 10*s.*

No. 54. THE RUSTS OF NYASALAND. By G. R. BISBY and P. O. WIEHE. 12 pp., 1953. 3*s.* 9*d.*

No. 55. LEAF SPOT OF ALEURITES MONTANA CAUSED BY MYCOSPHAERELLA WEBSTERI SP. NOV. By P. O. WIEHE. 4 pp., 1 pl., 1953. 2*s.* 6*d.*

No. 56. BRITISH SPECIES OF PERICONIA. By E. W. MASON and M. B. ELLIS. 127 pp., 1 pl., 43 figs., 1953. 30*s.*

No. 57. KEY TO THE SPECIES OF PHYTOPHTHORA RECORDED IN THE BRITISH ISLES. By GRACE M. WATERHOUSE and ELIZABETH M. BLACKWELL. 9 pp., 1954. 3*s.*

No. 58. SPECIES OF THE GENUS PARODIOPSIS FOUND IN TRINIDAD. By R. E. D. BAKER, 16 pp., 11 figs., 1955. 4*s.* 6*d.*

No. 59. NEW SPECIES OF UREDINALES FROM TRINIDAD. By W. T. DALE. 11 pp., 11 figs., 1955. 4*s.* 6*d.*

No. 60. A PRELIMINARY LIST OF JAMAICAN UREDINALES. By W. T. DALE, 21 pp., 1 fig., 1955. 5*s.*

No. 61. THE GENUS CEREBELLA. By R. F. N. LANGDON. 18 pp., 2 pl., 6 figs., 1955. 7*s.*

No. 62. A REVISION OF THE BRITISH HELOTIACEAE IN THE HERBARIUM OF THE ROYAL BOTANIC GARDENS, KEW, WITH NOTES ON RELATED EUROPEAN SPECIES. By R. W. G. DENNIS. 216 pp., 1 pl., 179 figs., 1956. 60*s.*

No. 63. A PRELIMINARY LIST OF PLANT DISEASES IN NORTHERN RHODESIA. By E. A. RILEY. 28 pp., 1 map, 1956. 9*s.*

No. 64. USTILAGINALES OF WEST PAKISTAN. By S. AHMAD. 17 pp., 8 figs., 1956. 6*s.*

Numbers are issued at irregular intervals. Until further notice a rebate of 33⅓ per cent. is allowed on new Papers to those who register for all numbers as issued, the charge to subscribers to the *Review of Applied Mycology* being added to their subscriptions for the succeeding year, others being billed annually. A binding-case for Mycological Papers 1–25 is now available, price 5*s.*, postage extra.

ALL publications are post free and, with the exception of Mycological Papers, all subscriptions are payable in advance. Foreign subscribers should pay by International Money Order or through the British Agents of their Bankers. Orders and correspondence should be addressed to the DIRECTOR, COMMONWEALTH MYCOLOGICAL INSTITUTE, FERRY LANE, KEW, SURREY.

CONTENTS

AUTHORS' NAMES

Andersson, 660
Andreucci, 679
Angell, 687
Anken, 666
Athow, 652
Aytoun, 701
Baker (E. P.), 670
Baker (R. E. D.), 637
Baker (S. D.), 636
Baldacci, 637
Banga, 649
Batts, 668
Baumann, 684
Baxter, 687
Beecher, 654
Beránek, 628
Bever, 668
Bingham, 690
Bishop, 650
Bitancourt, 662, 674, 691
Blumer, 683
Boedijn, 698
Bolaños, 663
Bonde, 630
Borlaug, 665
Borrow, 700
Bovey, 688
Brandes, 639
Brian, 700
Broda, 640
Brooks, 683
Brown, 626
Bruehl, 668
Burkholder, 641
Bushnell, 626
Buzzell, 638
Byrde, 684, 685
Caldwell, 652
Carew, 649
Caroselli, 645
Cash, 679
Casterman, 639
Chamberlain, 640, 652
Chauhan, 673
Chester, 700
Chubova, 631
Ciferri, 636, 696
Clarke, 684
Cloninger, 670
Connin, 669
Conway, 700
Cooper, 674
Corke, 685
Cox, 672
Croxall, 684
Curtis, 700
Dahl, 703
Dale, 637
Dame, 679
Damodaran, 690
Deshmukh, 629
Desrosiers, 663
DeWolfe, 676
Diachun, 641, 682
Diener, 632
Dierberger, 662
Doolittle, 654
Dorn, 627
Dunleavy, 681
Ebben, 655
Edwards, 654
Elarosi, 631
Ervin, 676
Fenn, 681
Fennell, 700
Frazier, 689
Freitag, 653
Furmidge, 693
Gallegly, 650
Galloway, 698
Gandy, 654
Garrett, 696
Geard, 689
Geddes, 665
Gerdemann, 625
Gill, 647
Gilmer, 686
Govinda Rao, 653
Graham, 682
Graniti, 677
Gray (R. A.), 700
Gray (W. D.), 626
Grein, 637
Grierson, 676
Grylls, 681
Guengerich, 686
Guillemat, 699
Guyot, 699
Győrfi, 646
Hack, 655, 656
Hagedorn, 640
Hamson, 649
Hanson, 682
Harley, 703
Harper, 684
Hawker, 696
Hayden, 664
Heinis, 688, 689
Helton, 686
Hemming, 700
Henehan, 700
Henson, 682
Hewlett, 665
Hildebrand, 632
Hoare, 694
Hoffer, 665
Holdeman, 641
Hooker (A. L.), 672
Hooker (W. J.), 629
Horner, 633
Horsfall, 696
Howard, 629
Howles, 655, 656
Hubbeling, 651
Hughes, 655, 656
Hurst, 631
Jacks, 691
Jackson, 700
Jeener, 638, 639, 650
Jeffers, 632
Jeffreys, 700
Jenkins, 691
Jensen, 667
Johnson, 697
Johnston, 665
Jones, 697
Kaplan, 703
Katumoto, 636
Kaufhold, 655
Kearns, 684, 693
Keener, 648, 649
Keitt, 625
Khan, 647, 690
Kilpatrick, 697
Kimura, 625, 626
King, 677
Klotz, 676
Koch, 641
Köhler, 630
Konzak, 671
Koteswara Rao, 653
Kotte, 683
Kunikata, 703
Kupila, 662
Langford, 700
Lauffer, 638
Lavand'homme, 638
Lawes, 677
Leaphart, 647
Leben, 625
Lee, 688
Lemoine, 638
Levine, 665
Lihnell, 689
Lindfors, 665
Lloyd, 700
Lucas, 641, 642
Mahapatra, 695
Marsh, 684
Martin (J. P.), 676
Martin (J. T.), 692
Massey, 656
Matuo, 646, 647
Messiaen, 635
Messing, 655, 656
Miller, 669
Millikan, 686
Minz, 676
Mitton, 702
Moisey, 686
Montégut, 699
Morgan, 684, 692, 693
Mülder, 648
Naito, 703
Nakagawa, 668
Natti, 651
Newhall, 676
Nixon, 700
Norris, 700
Ohms, 668
Olmo, 683
Orellana, 663
Oswald, 630
Pantyuhina, 631
Passler, 640
Person, 641
Peynado, 674
Pickard, 692
Poehlman, 670
Posnette, 689
Pote, 695
Radley, 700
Ramakrishnan, 673, 690
Raper, 700
Read, 655, 656
Reusse, 642
Reyes Núñez, 635
Robinson, 631
Rushdi, 632
Russell, 698
Sakurai, 646, 647
Salisbury, 648
Sanders, 663
Sarazin, 654
Schluns, 684
Schmitt, 637
Schönfeld, 640
Schönfelling, 640
Schroeder, 651
Schwarz, 662
Shaw, 637
Silberschmidt, 627, 678
Singh (B.), 683
Singh (R. S.), 682, 683
Skotland, 640
Smith (H. C.), 685
Smith (J. D.), 679, 680
Smith (R. J.), 655, 656
Sohns, 700
Somers, 692
Spalla, 637
Stahmann, 640
Steere, 637
Steineck, 629
Stephen, 642
Stevenson (E. E.), 65
Stevenson (F. J.), 627
Stobwasser, 694
Stodola, 700
Subramanian, 637
Suhovecky, 652
Sundaram, 673
Suneson, 670
Takai, 688
Thiem, 683
Thijn, 628
Thirumalachar, 698
Thomas, 695
Thomson, 629
Timmons, 688
Tollenaar, 663
Tommasi, 678
Trkula, 638
Tsukahara, 701
Turner, 702
Tveit (M.), 671
Tveit (M. T.), 700
Tyler, 667
Upadhyaya, 670
Valleau, 641
Vargas, 663
Varma, 653
Visser, 650
Volcani, 653
Wagner, 704
Wallace, 691
Ward, 687
Waterman, 646, 647
Watson, 679
Webb, 630
Weiser, 677
Wellman, 663
Wenger, 703
Weyreter, 697
Whiteside, 677
Wiebe, 649
Wilhelm, 654
Williams, 655, 656
Windisch, 702
Winsor, 656
Witsch, 704
Wood, 671
Wright, 701
Yamada, 632
Yamamoto, 632
Yukawa, 636
Zadina, 628
Zak, 648
Zaubitzer, 642
Zentmyer, 690
Zscheile, 666

SUBJECT INDEX

Antibiotics, 625, 631, 654, 700–1
Bacteria, 662
Diseases and disorders of:
  Apple, 683–6
  Banana, 690
  Cacao, 663–4
  Cereals, 664–73
  Citrus, 674–7
  Cotton, 677
  Fibre plants, 677–9
  Flowers and ornamentals, 679
  Fruit, 683–91
  Herbage crops, 679–83
Insects, 677
Leather, 702–3
Mushrooms, 654
Officinal plants, 699
Potato, 627–32
Rice, 632–3
Spices, 633
Sugar beet, 650–1
Sugar-cane, 633–5
Tobacco, 637–42
Trees and timber, 642–9
Vegetables, 649–54
Vine, 655
Fungicides, 691–6
General publications, 696–7
Genetics, 625
Hormones, 703–4
Lists of fungi or diseases, 635–7
Mycorrhiza and symbiosis, 625, 703
Physiology, 626–7, 697, 703–4
Reports from Cheshunt Experimental Research Station, 655–6; Commonwealth, 660; Forest Research, 64
Imperial Forestry Institute, O
ford, 643; Long Ashton Researc
Station, 684, 692, 693; New
Wales, 661; Outdoor Vegetab
Research Station, Holland, 65
Phytopathological Conferenc
Italy, 658; Swedish Seed Associ
tion, 660
Soils and fertilizers, 701
Systematic mycology, 635–6, 637, 69
Technique, 697–8
Virus diseases, 628–9, 632, 637–40, 64
51, 653, 669–70, 674, 678, 681, 68
683, 686, 688, 689, 690
Yeasts, 701–2

THE Executive Council of the Commonwealth Agricultural Bureau is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.